THE

SUGAR CANE:

A MONTHLY MAGAZINE,

DEVOTED TO THE INTERESTS OF THE SUGAR CANE INDUSTRY.

JANUARY TO DECEMBER, 1890.

VOLUME XXII.

MANCHESTER:
JAMES GALT & CO., 2, CORPORATION STREET, PUBLISHERS,
1890.

INDEX TO VOLUME XXII.

PAGE

THE

SUGAR CANE.

No. 246. JANUARY 1, 1890. Vol. XXII.

☞ The writers alone are responsible for their statements.

Cheques and P.O. Orders to be made payable to The Proprietor, 6, Ward's Buildings, Deansgate, Manchester. All other communications to be addressed to The Editor, at the same address.

For Table of Contents, see page i.

The news from Brazil received since our last is not altogether reassuring, but we may still hope that no very serious disturbance of the *status quo* will take place.

The following details of progress of the country, which are obtained from a publication issued this year by a Brazilian Scientific Society, may be interesting at this conjuncture. The population has increased from less than 10,000,000 in 1867 to over 14,000,000, its trade from £36,000,000 to £50,000,000; its annual budget from £9,200,000 to £22,800,000; its railways from 422 miles to 6,210 miles; its tonnage, in and out, from 4,000,000 to 10,000,000 tons. The annual immigration is 150,000. The provinces showing the greatest increase are those of Amazonia and Para. The yearly export of the latter is £8, and that of the former £7 per head of the population. This rate of increase, great as it is, may be kept up for many years, if the change of Government should turn out to be one that will favour the real interests of the country, for much of the enormous territory of 3,219,000 square miles is as yet almost unexplored. We give on page 37 a copy of the conclusions arrived at by the Commission appointed to study the diffusion question in Guadeloupe. The wording and arrangement are curiously like the circulars issued by some of the French manufacturers of diffusion plant, and read very like a copy.

The trade of Calcutta seems to continue to prosper. The tonnage, in and out, for 1888-89 was 4,486,300, against 4,466,970, in 1887-88.

The latter was the highest figure attained up to that date. The sugar imports for 1888-89, as compared with the preceding years, were as follows:—

	1887-88. Cwt.		1888-89. Cwt.
From the United Kingdom ..	35,292	....	113
,, ,, Mauritius	52,584	....	98,446
,, Hong Kong	61,520	....	9,426
,, Singapore	19,291	....	10,275
,, Java	33,935	....	—
,, Austria	4,080	....	—

In addition 54,497 cwt. were obtained from Bombay during the year 1888-89, the greater portion being from Mauritius. Some success has been obtained with beetroot sugar, but the prejudices of the natives will probably prevent any great quantity from finding its way into the country.

We have received a copy of Mr. Guildford L. Spencer's *Handbook for Sugar Manufacturers*, which seems to contain almost everything that is necessary for sugar houses where a regular oversight of the various workings is kept by a practical chemist. It contains tables and formulæ, and plenty of blank forms for practical use. The adoption of a regular system in keeping these records cannot be too much insisted on, as unless the same mode of tabulating results is adopted for each year, the comparison of results becomes scarsely possible. The pocket book can be obtained from Messrs. John Wiley and Sons, Astor Place, New York.

Parcels are now accepted for transmission by parcels post to Turk's Islands, *viâ* Jamaica. Rates: Not exceeding 1 lb., 9d.; for each lb. or fraction thereof additional, 9d.

The United States Consul at Kingston, Jamaica, reports to the State Department of Washington the sale of the railway system on that island by the Colonial Government to a syndicate of citizens of the United States, subject to the approval of the Home Government. The railway system was begun in 1843, and now consists of 63½ miles in operation, and 119¼ miles to be constructed. The lines already built cost nearly £500,000. The number of passengers carried in the year ending September, 1888, was 284,923.

We learn that the First Prize for the best Portable Engine, and also for the best Thrashing Machine at the Agricultural Exhibition of Santiago (Chile), at which most of the principal English and American Machine Makers are represented, has been gained by Messrs. Ruston, Proctor & Co., of Lincoln.

Information has been received from Queensland that the Torres Straits route is no longer advantageous for correspondence addressed to the southern part of the colony. While, therefore, the monthly mails for the north of Queensland (Thursday Island, Cooktown, Port Douglas, Townsville, Bowes, and Mackay) will still be sent *viâ* Torres Straits, the despatch of mails by that route to the south of Queensland has been discontinued in London.

Correspondence for Brisbane, Bundaberg, Gladstone, Maryborough, and Rockhampton will be forwarded in the mails *viâ* Adelaide.

Nothing is so dear as cheap machinery! Complaints are being made in Louisiana of the impossibility of thoroughly crushing the canes this season, owing to the mills being too weak, the late dry season having resulted in exceedingly hard canes. Those who have luckily lately provided themselves with new and stronger mills are congratulating themselves on their good fortune.

The last Consular report from Porto Rico indicates a falling off in the production of sugar; owing to want of capital, much land is going out of cultivation. The exports for the past year amounted to about 60,000 tons. Over one half of the exports are to the United States; Great Britain takes not quite one quarter; the remainder goes to British West Indies, Spain, and Cuba.

Professor Harrison, who will already be favourably known to our readers through his experiments on the possibility of raising sugar cane from seed (see *Sugar Cane* for January, 1889), has been promoted from Barbadoes to Demerara, as government analytical chemist. The *Barbadoes Agricultural Reporter* says:—Professor Harrison is to be congratulated on his promotion. But we believe we correctly interpret the feelings of the whole community, and especially of the planter section of it, when we say that his removal from Bar-

badoes will be universally regretted. To say nothing of his professional skill, a more honest, upright, and honourable public officer has never been to Barbadoes. It is impossible to speak too highly of the services he has rendered to agriculture since his appointment in 1879. Thanks to his unwearied efforts, an impetus has been given to the study of agricultural chemistry in the island; the nucleus of a botanical institution has been established at Dodds; the gross frauds which used to be perpetrated on the planters by manure vendors have been put an end to; and the sugar crops have greatly increased.

This is a pleasing testimony to the value to the agricultural and manufacturing industries of a clever, practical chemist. We may just remark, with regard to the question of sugar cane from seed, that Bruce says that in Abyssinia the sugar-cane was so raised.

The imports of French raw sugars by our Glasgow refiners have lately considerably increased. Apropos of this fact, the *Journal des Fabricants de Sucre* remarks:—"We may state that as regards the manufacture of raw sugar for refining, the French factories can supply the English refiners with brown sugars equal to those furnished by the Germans, Austrians, and Belgians. As regards white crystallised sugars, nothing prevents our manufacturers from entering into competition with other countries, and the best proof of this is the fact that certain French factories could, if they were willing, dispose of the whole of their production in white sugar in the English market."

An interesting report on the trade and commerce of Cuba has been sent home by our resident Consul at Havana. We give on pages 21 to 29 copious extracts which will be found valuable as giving a comprehensive idea of the sugar trade and the interests immediately connected with it.

We have already on two or three occasions referred to the proposals for the establishment of an International Sugar Bank. There have been strong objections expressed to this in Germany (see remarks in our December, 1889, issue), and these have resulted in a proposal for a National German Sugar Bank, and a general meeting of the Union of German Sugar Manufacturers is to be called at the close of the present campaign to consider the question.

Since the end of October the following results of German and other Continental sugar factories for the 1888-89 campaign have been announced. These are obtained, as usual, mainly from the *Deutsche Zuckerindustrie*:—

DIVIDENDS DECLARED.

Immendorf (capital M. 330,000), 45%; *Heilbronn* (capital M. 1,660,715). 15%; *Bennigsen* (capital M. 683,000), 11%, besides dividend to beet contractors; *Klein Wanzleben* (capital M. 2,400,000), 5% on Preference and 4% on Ordinary shares.

NET PROFITS SHOWN.

Brühl (capital M. 1,050,000), M. 254,750; *Neuwerk* (capital M. 1,500,000), M. 162,514, which goes in partial liquidation of old debt balance, the latter still remaining at M. 58,445; *Königslutter* (capital M. 240,000), M. 191,063; *Niederhone* (capital M. 460,000), M. 124,573, of which over half goes to cover previous losses; *Offstein* (ordinary shares M. 211,200, preference do. M. 410,000), M. 77,162; *Tuczno* (capital M. 591,000), M. 46,371, nearly half of which goes to clear off last year's adverse balance. *Braunschweig* made a net profit of M. 19,438, which is mostly absorbed by a loss from bankruptcy. The reason of the small dividend paid this year by the *Badische Gesellschaft für Zuckerfabrikation* (capital nearly M. 5,000,000) is their having had to meet two losses by bankruptcy, amounting to over M. 40,000.

REFINERIES.

The large Halle Refinery pays 12%, not 10% dividend, as previously announced. About one-third of the M. 750,000 profits was obtained by re-sale of raw sugar during the high prices. The *Strontianit-Societät* (Rositzer Zuckerraffinerie) pays 9½%. The *Mannheim Zuckerraffinerie* has lost M. 6,721, in addition to losses by bankruptcies amounting to M. 38,725. The crisis in Magdeburg was very unfavourable for this refinery, which had to cease operations in June. The same cause interfered with the operations of the Braunschweig, which only pays 3% dividend, but the *Brunonia* (Braunschweig) having bought early at comparatively low prices, pays 12% dividend.

AUSTRIA.—The Pecek Refinery only worked for less than two months, but pays 4%. The erection of three new factories is being talked off at Pesth, to be set up at Kaposnova, Dombovar, and in the neighbourhood of Arado.

1889.

The eventful year 1889 has departed, leaving behind it a rich legacy of experiences. The good old custom of taking an annual retrospect, so as to profit by the lessons of the past, is a thoroughly sound and reasonable one, and on coming to review the history of the past twelve months of the sugar trade, we find an unusually large supply of material for ripe deliberation.

To begin with, the past year has witnessed such a phenomenal upward rush of prices as we shall look for in vain for many years previously. If anything special was wanting to prove how completely the trade is at present dominated by the Continental beet production, we have now surely had a convincing proof, a repetition of which is scarcely to be desired. The fact that the remarkable swindle in Magdeburg, for such combinations can scarcely be otherwise rightly described, could for a time be so successful, and might just possibly have been altogether successful, points to some radical defect in the conceptions at present prevailing as to the factors which go to produce the movements of the sugar market. In this connection we would call attention to an article by the statistical editor of the *Prager Zuckermarkt*, a translation of which we have given on page 9. This article is a praiseworthy attempt to throw light on a dark question, which is beset with special difficulties. Those who have tried to follow the extraordinarily involved maze of opinions on the silver question, as expressed by leading men, will not be discouraged by the fact that the article in question does not appear altogether conclusive.

That combination of some kind on the part of producers may do good, and even become imperatively necessary in the face of combinations of capitalists, is very possible, but that they will be difficult to organise is certain. The most likely direction is that taken by the Germans, in the promotion of what they call a *Sugar Bank*, but such organisations are little likely to be extended to our colonies, and the West India planter will not take much interest in them, except as seeing in the movement a closer arraying of the ranks of his opponents.

The evils of such combinations as the Magdeburg Syndicate do not consist in their success, for as a rule they are not successful, nor are they likely often to be so, as was pointed out in an article "On Syndicates" published in our issue of October last year. Their worst

effects are the temporarily complete disturbance of the healthy current of trade, and the diversion of capital from its legitimate channels. The cause of the disastrous failure in this instance is not far to seek; the combination miscalculated the quantity of sugar in stock in Germany, or, rather, in Hamburg, basing their operations eventually on the supposition that these were not sufficient to meet the requirements of those who were attempting to countermine them, and they lost their heads at the critical moment. But their operations were at first based on another supposition, viz., that the visible stocks were insufficient to meet the universal consumption till the new beet crop should be coming round. And this fact, for fact it certainly was to some extent, may well lead those interested to be on the look-out, for it is by no means impossible that a repetition of the short supply scare may be awaiting us next spring or summer. It cannot be too strongly insisted on that the phenomenal rise in prices which commenced last March was at first fully justified by the circumstance of the visible supply being probably insufficient to meet the demand, and that such a conjuncture may possibly occur again during the year just entered on.

Another noteworthy fact is this, that during the first nine months of the past year, up to the end of September, the visible stocks were considerably below those of the preceding year, the minus having during the four months from 1st April to 1st August remained almost stationary at the high average deficit of 355,000 tons. Not until the 1st October do we at last find a small excess becoming evident over ths stocks at the same date in the previous year. It is evident that the rapid advance in prices, combined with the deficiency in the visible stocks, had the effect for a lengthened time of inducing buyers to keep on providing themselves, even in spite of the high rates prevailing, as they feared a sugar famine, in face of the certain deficiency in the Cuban crop and the uncertainty of matters in the Philippines and Java, the only quarters to which we could look for any immediate relief.

But although the expectations of a deficiency on the 1st October were not realised, owing to the decrease in consumption and the large imports from various quarters (between 300,000 and 400,000 tons), stimulated, undoubtedly, by the high prices, it must be remembered that the beet sugar campaign of 1889 commenced with a relatively small amount of visible stocks, viz., somewhat over 520,000 tons,

while in preceding years the quantities had been—1885, 1,120,000; 1886, 868,000; 1887, 732,000; 1888, only 496,000 tons.

The progress of the beet sugar production is a further remarkable fact; the increase is steady and is likely to continue, as movements are on foot for extending it in the South of France, in Sweden, in California and some other States of the Union, and possibly also in Canada.

The following are the average prices for German and Austrian 88% beet, West India, and Java Sugars during the past seven years:—

GERMAN-AUSTRIAN BEET, 88%.

	1883.	1884.	1885.	1886.	1887.	1888.	1889.
First Quarter..	20/-	17/1	11/5	13/7½	10/10	14/9	13/11½
Second ,, ..	21/3	14/7¾	14/6	12/1½	11/8½	13/5	20/4
Third ,, ..	20/7	13/6	15/2	11/1½	12/7	14/3	21/5
Fourth ,, ..	18/9	10/6½	14/9½	10/9	13/7	13/3	12/1
Year's Average.	20/1½	13/11	13/11½	11/10½	12/2	13/11	16/11½

WEST INDIA.

	1883.	1884.	1885.	1886.	1887.	1888.	1889.
First Quarter..	19/10	16/7	11/4	13/6	10/8	13/6	13/3
Second ,, ..	21/2	14/0	14/10	12/3	11/-	13/-	17/6
Third ,, ..	20/2	11/4	14/10	11/4	12/-	13/-	20/-
Fourth ,, ..	19/-	11/2	14/11	11/3	13/7	13/4	13/2
Year's Average.	20/-	13/3¼	13/11¾	12/1	11/9¾	13/2½	16/-

JAVA.

	1883.	1884.	1885.	1886.	1887.	1888,	1889.
First Quarter..	24/-	20/8	14/7	15/4	13/2	16/1	16/9
Second ,, ..	24/7	18/3	17/6	14/3	13/7	15/7	21/9
Third ,, ..	24/1	15/8	17/1	13/3	13/10	13/10	22/7
Fourth ,, ..	22/10	14/8	17/7	13/5	15/9	15/9	15/3
Year's Average.	23/10½	17/3¼	16/8¼	14/0¾	14/1	16/1¼	19/1

The question whether diffusion is or is not the most advantageous system for the cane cannot yet be regarded as settled. Very favourable reports of results obtained have been issued during the past year, but good results have also been obtained by the old process with the improved crushing apparatus. The fuel question seems yet, for many of our planters, to stand in the way, and the advance in the prices of coal during the past six months has raised grave doubts as to whether the extra gain in sugar may not be more than counterbalanced by the higher cost of the extra fuel required. The difficulty with the chips can only be overcome by the use of special furnaces, and even those who are not novices appear, if we may judge by remarks in American papers, to be rather troubled with the working of their diffusion plant.

Sorghum sugar continues still in the same doubtful position. A number of the companies organised last year in Kansas are in difficulties, and though various reasons for the failure of the crop, such as disregard of past experience and want of caution, are alleged, the successful production of sugar from sorghum seems, in spite of the unwearied exertions of Professor Wiley and others enthusiastically interested in the question, almost as far off as ever.

The American Sugar Trust has had the worst of the late contest, but is by no means rendered powerless, and the coming struggle between the combination and Claus Spreckels, who has of late been credited with much "tall talk," will be awaited with considerable interest.

The London Convention remains, since the withdrawal of the Bill from the English Parliament, pretty much in *statu quo*. In this matter probably the wisest man will be he who does not prophecy, but we see no reason why the Bill withdrawn last year, or a similar one, should not be reintroduced this session. The large bounties obtained in France may be seen from a statement on page 18 of the present issue.

Electric Sugar Refining proved a colossal swindle. Perhaps the only redeeming feature was the fact that the victims were, in very many cases, not those practically engaged in the sugar trade. Rumours of another scheme are afloat.

Attentive readers of our columns must have been struck with the large profits which German sugar factories still continue to make. We have studiously given, from time to time, all possible *reliable* figures, so that those interested may endeavour to draw conclusions.

REVIEW OF THE MOVEMENTS OF THE SUGAR MARKETS IN THE CAMPAIGNS OF 1880-81 TO 1888-89 INCLUSIVE.

BEING A CONTRIBUTION TO THE THEORY OF HOW SUGAR PRICES ARE PRODUCED.

(From the *Prager Zuckermarkt.*)

During the period under review, with the exception of the third and last campaigns, the export of cane sugar steadily increased, whilst the production of beet sugar rapidly ran up till 1884-85, after which it oscillated violently up and down. Corresponding to this, the total production of cane and beet sugar mounted rapidly up to

1884-85, and has since fallen and risen with regular alternation. The deliveries for the world's consumption kept pace on the whole with these movements, but there are some specially noteworthy features in their course. Thus in 1883-84 there was a sharp falling off in these deliveries, followed by a still sharper advance, and the consumption remained at the high point which it had so quickly attained, a distinct proof that the very low prices of sugar not only had the effect of temporarily increasing the deliveries for consumption, but also of increasing the consumption itself to an unusual extent. This increase in the world's consumption became so marked that since the campaign of 1885-86 it has exceeded the production, and the four last campaigns have all been *campaigns of under-production.*

This state of things naturally made itself felt in the position of the general stocks, and consequently, in the movements of the stocks up to 1884-85 and especially in the latter campaign, there is a rapid growth, but from that time a diminution sets in, not large at the commencement, but since 1886-87 a steadily increasing diminution, until at the beginning of October last year, and again this year, they had fallen to the level of 1880, while the world's consumption has increased since then by 32%! The stocks at the present moment, however, show larger quantities in individual cases (America and Germany).

With regard to the movements of prices, there are two features which should be noted. Firstly, the almost feverish oscillations from June, 1885, to January, 1886, when it was impossible to form any definite opinion in face of the enormous falling off in the beet sugar production, on the one hand, and on the other the high figure at which the stocks steadily remained. Secondly, the upward movement in the quotations in January, 1888, which was originally induced by the decline in the stocks, but was afterwards so completely met and overcome by the forward sales of raw crop made at the same time at low prices by the manufacturers, that the low prices of sugar were as a consequence maintained until March of the present year.

Much more that is interesting might be said about the movements of prices, but we prefer to turn to the principal object of our review, viz., the theory of the formation of sugar prices, though even here we must confine ourselves to specially indicating some principal points.

When we come to compare the monthly movements of prices on the one hand and stocks on the other, we see that on the whole the two

movements run parallel, *i.e.*, that the falling of stocks is accompanied by a decline in prices, and that an increase of stocks takes place at the same time as an advance in prices. This seems paradoxical, when looked at mechanically, as we should expect rather an advance in prices with a falling off in stocks and *vice versa*.

This relation between prices and stocks is, however, based on the nature of the case, and we think we see in this a justification for deducing therefrom the first and at the same time the principal axiom in regard to the theory of how prices are brought about, viz. :—

1. The turn which prices take is not so much dependent on the present, but rather on the future. In establishing the prices of sugar the statistical position of the article which may be expected is discounted beforehand, at times, no doubt, as we shall see further on, in a purely mechanical way, utterly regardless of the real nature of the situation.

In this manner the fact becomes explicable, that with a diminution of stocks, which is the most strongly marked before the commencement of a campaign, there should also exist a reduction in prices, for the very reason that the opening of the campaign is close at hand, which brings with it at any rate a relative abundance of supply as a consequence of the large production of the first months of the campaign. But with the growth of the stocks, the campaign, and concurrently the larger production begin to draw to a close, and the period of the months of consumption approaches, which fact is also discounted beforehand in the prices.

2. The second axiom which we wish to establish is that the formation of the prices is more (occasionally exclusively) influenced by the beet sugar production than that of colonial sugar. The reason is, firstly, the beet sugar lies much nearer to the world's market than the colonial sugar; and secondly, its statistical position can be better and more accurately gauged. The first is a psychological, the second a material reason.

This state of things is most evidently shown by the last campaign. There was a considerable falling off in the supply of cane sugar, but the beet sugar production promised to be larger, and so the prices of sugar *must* remain at a low level.

3. The full season of the beet sugar production has an unfavourable influence on the formation of prices of sugar, not only for the first reason given above, but also because concurrently with the larger production large quantities are, as a rule, being offered for sale. In

one word, the sugar industry does not go about the offer of its goods in a tradesman-like manner. At the height of the season the market is flooded with goods, and, more than this, it is flooded in a completely disorganised manner, because the manufacturers go into the market individually and in numbers, and in this way naturally and necessarily compete one with another, and force prices down one against the other.

Years ago we pointed out in personal intercourse the necessity of a mercantile organisation for the sale of the products of the sugar industry, and we see with inward satisfaction that the conviction we then arrived at is now making its way, at the outset, it is true, in Germany, as the sugar manufacturers there are taking into serious consideration the establishment of a Sugar Commission Bank. There can be no question of a mercantile organisation until the mutual underbidding on the part of the sugar manufacturers is made an impossibility by the sales being combined in one hand.

What a grand blessing such an institution would have been during the past few years to the industry is evident from the following consideration. Since 1885-86 we have been living in a time of universal *under-production*, but prices showed no indication whatever of this, the price went down in a purely mechanical fashion before the commencement of the campaign, because—the campaign was about to begin! No one thought of asking what the campaign was really going to bring with it, or what would follow after the campaign, and only in this way could it possibly happen that the late outrageous upward rush of prices only commenced after the manufacturers had already sold their produce. Looking at the market of the world, and endeavouring to form an opinion about it, we verily cannot help sighing over the want of rational action which prevails. For, even though it may not be possible to bring the monthly movement of stocks and prices into close connection, this should most certainly be the case as regards the annual movements. If the movement of stocks for the year has a downward tendency, then the direction of the movement of prices for the year should be upwards. That this is not so is proved by an inspection of the facts of the case for the past few years, and we consider that the principal reason of this, logically considered, absurd phenomenon is to be found in *the want of any commercial organisation on the part of sugar manufacturers in the disposal of their produce.*

THE SUGAR CONVENTION BILL IN BARBADOS.

From the *Barbados Agricultural Reporter.*

A public meeting was held on 22nd in the Assembly Rooms, Public Buildings, for the purpose of considering what steps should be taken to urge on the Imperial Government the necessity for passing through Parliament, as soon as practicable, the Sugar Convention Bill. The meeting, although not large, was a very representative one. The Hon. G. C. Pile, President of the Legislative Council, was, as President of the Agricultural Society, voted to the chair, and, after a few appropriate remarks, moved the following resolution, which was seconded by Mr. J. Gardiner Austin, jun., supported by Mr. T. C. Roberts, and unanimously carried:—

"That this meeting, representative as it is of all classes and interests of the community, is desirous of conveying to the Imperial Government its thorough approval of their exertions to put an end to the system of Sugar Bounties at present existing on the Continent of Europe, a system which strikes at the root of the cane sugar industry in all its branches, both in England and the Colonies; and would respectfully urge on the Imperial Government the necessity of taking such steps as will lead to the prompt re-introduction into and passing through both Houses of Parliament the Sugar Convention Bill, which it was unfortunately found necessary to withdraw last session."

On the motion of Mr. Robert Challenor, seconded by the Hon. W. P. Leacock, a deputation was appointed to wait upon the Acting Governor with a copy of the foregoing resolution, and to request His Excellency to take the necessary steps for forwarding the resolution to the Secretary of State for the Colonies.

THE GERMAN SUGAR DUTIES.

DEBATE IN THE REICHSTAG.

When we consider the prominent part taken by the German Government in the negotiations connected with the London Sugar Convention, anything relating to the sugar question which crops up in the course of debate in the Reichstag seems worthy of being recorded. We therefore make no apology for the following translation of remarks which were made at the sitting of the 9th December, by

one of the deputies, Dr. Witte, on the occasion of the second discussion on the Budget: Alluding to misrepresentations which he alleged had been made of his views in a former discussion, the deputy said:—

"In the speech from which quotations were made, I characterised the complete abolition of the tax on beets as a pressing necessity, and I maintain my position to-day still more decidedly and energetically, while considering the existing law as an advance on the former one, however peculiar may be the consequences resulting from it. By means of it, we have materially diminished the tax on beets, and, consequently, the premiums, and above all, we have attained to the introduction of the tax on the manufactured article, *i.e.*, on consumption. When we only think of the objections, which, even until quite lately, have been made by the various governments to the introduction and carrying out of the tax on consumption, we cannot but consider its introduction as a great step in advance; this has been easily effected, and will most certainly eventually bring in the full amount at which it was estimated, even though that may not yet have been attained in the present year, owing to the state of transition. On the other hand, we ask ourselves, "can the representatives of the nation undertake the responsibility of allowing the tax on beets to exist any longer?" After going into lengthy statistical details in support of his proposition, the deputy continued:—"The Prussian Minister of Agriculture, whom I must, from his position and the office he holds, perforce consider as the one most thoroughly acquainted with the question among the representatives of the Federal Government, is also the one who has fought the longest and the most energetically against any alteration whatever of the fiscal legislation with regard to sugar. I think he would himself be astonished, if he were to read through the speeches of the past ten years, at the assertions he has made. What are the consequences of our having adhered to this imperfect mode of taxation? In 1886, the Minister of Agriculture himself warned the landowners and those engaged in the sugar industry, against an immoderate extension of the beet cultivation. That was in the same speech in which the Minister put to me the question—What is molasses? In which he also further said that the sugar industry stood or fell with the tax on the raw material. Well, has it fallen now that the tax has been introduced, and the premiums are diminished by half, in consequence of the reduction of the tax on beets? At that time, Herr v. Bennigsen spoke also of the great dangers which we might incur. Of all these apprehensions, not

one has been verified; on the contrary, the sugar industry has only been too full of vitality, for it has become lulled into a deceptive dream of security, as if the present system could be maintained for a lengthened time. At the present moment, so far as I am informed, ten new sugar manufactories are being erected, and the entire development of things is such that a severe crisis is impending. The Federal Governments will then incur a heavy responsibility if they undertake to wait for an event which, at the earliest, cannot come into force till the 1st September, 1891, and the coming into existence of which is, to say the least, very problematical, before coming to a decision with regard to this tax and the reforms to be introduced. I heartily desire to see the Convention with England and other States come into existence, and the abstention of individual sugar producing countries can be no reason for not taking part in that Convention, if for no other reason than that these States will, in the interest of their own industry, quickly be compelled to seek admission as soon as the Convention has come into operation. Whither this sort of economical policy will lead us is shown at once by the demand of one of our number that something should be done for tobacco, because the Government was sacrificing yearly 20 millions for sugar. It is indeed not easy, when one industry is favoured in such a manner, to object to others, which perhaps more pressingly require help, preferring similar requests. The necessity of granting premiums if the tax on raw material is abolished, is not at this time under discussion. The question at this moment is whether, in face of the development attained by the industry under the existing system and fiscal legislation, we can undertake the responsibility of allowing the present tax on beets to remain, or whether it is not the duty of the Government to abolish it, as soon as this can be done in the interest of the industry as a whole. To leave things to take their natural course cannot be admitted, because by so doing the belief would be excited that if the Convention were not to come into operation, then things would remain as they are. There is therefore serious reason for the Government to enter at once, and with full energy, into the discussion of the question, whether the tax on beets can be maintained, or whether it must not be got rid of as soon as possible."

The Secretary of the Treasury, Herr v. Maltzahn, remarked: "I only wish, in reply to the statements of the preceding speaker, to point out that the period when the decision will be arrived at whether the London Convention is to come into existence or not, which he

indicates as being so distant, will occur in the course of the coming summer."

Fürst Hatzfeldt:—"It is impossible to come to any decision to-day with regard to the sugar tax. We must wait and see whether the London Convention comes into operation. We shall be able to do away with the premiums if the other States give in their adhesion. At the same time, I am also of the opinion that if the Sugar Convention should fail to be brought about, we cannot proceed any further in that direction. We already took the first step two years ago in the reform of the sugar duties, and in this connection I should like to remind the House that even Herr Witte acknowledged that the premiums could not be abolished all at once, but that there must be a gradual transition. In reference to this, Herr v. Kardorff last year mooted the idea of granting fixed premiums, as, for instance, one mark per centner, which should be distributed according to the production of the various factories. This would, any way, be only half of the premium now paid on export."

SUGAR AS A REMEDY FOR BOILER INCRUSTATIONS.

(A Letter to a Louisiana Paper).

It is now three years since you brought to notice the experiment of an Italian engineer employing sugar to prevent boiler incrustation. I tried it immediately afterward, with the success claimed, and have employed it ever since. Our feed water, coming from a well, being excessively bad, we had great trouble to get rid of the scales. The boiler was very old, about thirty years, and we intended to buy a new one. So I thought if any harm should come of the sugar, there would not be much lost. With the sugar, of which I employed three pounds of the brown kind, and a handful of wash soda, in four weeks we found a heap of sandy mud on the second sheet, or above the grate, the flues being covered with scales as usual, but the scales were soft and easily removed. The same thing happened with a new tubular steam boiler. We find most of the solid matter above the grate, and the tubes and boiler sheets covered with a thin adhering film of scales as high as the water reaches. Above the communication with the mud drum the tubes are thickly covered with soft scales after heavy rains, but under the scales the metal is as sound as when new.

DURATION OF THE SUGAR CAMPAIGN IN VARIOUS COUNTRIES.

The time at which the manufacture of sugar commences and the period of its duration vary remarkably in different countries. There is no portion of the year during which the production is not being carried on in some portion of the globe. The month when there is the least activity is perhaps July, when (with the exception of Peru with its comparatively insignificant production, which goes on all the year round) only the Java manufacturers, who commenced in the preceding month, are at work. The busiest month, having regard to the area of activity, is January, for at that time every sugar producing country of the world is at work. As a means of assisting in estimates of probable sources of supply at given periods, the following table may be of use. The * indicates activity, the — rest.

COUNTRIES.	Jan.	Feb.	Mar.	Apl.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1. Europe & U. States..	*	—	—	—	—	—	—	—	—	*	*	*
2. Cuba, Guadeloupe, Martinique, Porto Rico, &c........	*	*	*	*	*	*	—	—	—	—	—	—
3. Java..............	*	*	—	—	—	*	*	*	*	*	*	*
4. Trinidad and Barbados, Egypt and the Philippines..	*	*	*	*	*	*	—	—	—	—	—	*
5. Brazil	*	*	*	*	*	—	—	—	*	*	*	*
6. Mauritius & Réunion	*	—	—	—	—	—	—	*	*	*	*	*
7. Brit. Guiana, Jamaica and Natal..	*	*	*	*	*	*	—	—	—	*	*	*
8. Hawaii Islands	*	*	*	—	—	—	—	—	—	—	*	*
9. Peru..............	*	*	*	*	*	*	*	*	*	*	*	*

The production is estimated approximately as follows, the quantities being in tons, for 1888-89 campaign:—

Group	1	2,756,000
,,	2	708,000
,,	3	364,000
,,	4	393,000
,,	5	210,000
,,	6	161,000
,,	7	153,000
,,	8	120,000
,,	9	40,000
		2,905,000

The East Indies are omitted, as they import as much as they export.

FRENCH SUGAR LEGISLATION AND BOUNTIES.

(See *Sugar Cane* for November, 1889.)

The French Minister of Finance has fixed the allowance for waste in manufacture (*déchet de fabrication*) on Colonial sugar exported to the mother country during the campaign of 1889-90 at 26·19 per cent.

Apropos of the above, the *Deutsche Zuckerindustrie* makes the following remarks :—

Taking the percentage of *excédents* thus officially stated, there is, with the present duty of 40fr. per 100 kilos. of refined sugar, a premium of 10fr. 48cts. On the metric centner of raw sugar it amounts to 10fr. 33cts. (3s. 8¾d. per cwt). It appears, then, that in the campaign 1888-9 the French sugar manufacturers obtained on their production of 414,600 tons of refined sugar the total sum of 43,450,279fr. (£1,738,000). In addition to this, the French Colonies received as *déchet de fabrication* on the quantity imported thence, viz., 120,887 tons raw (=108,778 tons refined) sugar, a drawback equal to the average amount of the premium obtained by the home manufacturers in the preceding campaign, which was 13fr. 62cts. per 100 kilos. of refined sugar. This makes a further sum of 14,818,256fr., and thus the State has paid over a total sum of 58,268,535fr. (£2,330,700) by way of assistance to this branch of industry! This year the total premiums will, of course, amount to a considerably larger sum.

SORGHUM SUGAR NOT A SUCCESS.

From the *New York Times.*

Sorghum sugar was the favourite topic in Western and South-Western Kansas last summer. Thousands of acres of cane had been planted in the supposed sorghum-producing belt, five or six sugar mills were being erected in as many towns, and visions of wealth danced before the eyes of farmers who had suffered three successive crop failures. "Sorghum sugar will be our salvation," was the burden of their cry, and it was taken up throughout the State and believed by all interested in Kansas' progress. Even the State Board of

Agriculture caught the fever, and its reports were calculated to give one the impression that in the near future Kansas would outrank Louisiana or the Sandwich Islands in the production of sugar. To-day the State board is "singing low," the farmers are despondent, the mills are either closing down or going into the hands of receivers, and the word "failure" can be written against the industry which to the enthusiasts promised so much three months ago.

Utter disregard of the experience of men who have experimented for years with sorghum in Kansas has characterised the operations of those who have sunk upward of half a million dollars this year in the attempt to secure a profitable output of sugar. They have proceeded with as much confidence as if the problem of converting cane into cash had long since been solved, overlooking the fact that for some time sugar mills have been in operation in Topeka, in Fort Scott, and in Conway Springs, and the public has not been favoured with statements concerning their success or non-success.

If there has been a dividend declared by either of the companies owning these plants no outsider is aware of it. If there have been any profits they have quietly been pocketed. If the mills have ever paid expenses, a remarkable silence as to that important item has been preserved. Last spring several Kansas newspapers took up the question of sugar making, and asked the mill owners for statements of dividends or gross profits. The query was fruitless. The mill men made no public utterances, but at the same time did not try to undeceive those who thought that fortunes were to be made by extracting the sugar from Kansas cane, despite overwhelming evidence showing that the experimental stage in sugar making was not yet over. The farmers of the West and South-West prepared last spring to increase the acreage of cane, and even those of Eastern and South-Eastern Kansas planted larger acreage than formerly. Then a cry went up for more and better sugar mills. The enthusiasts declared that sorghum could not fail to mature in Kansas, that it grew regardless of the weather, and all that was needed was a sufficient number of mills to convert it into sugar. Early in the season the citizens of Attica, deluded by the optimists, bonded themselves in $75,000 to build and equip a mill. Those of the town of Liberal went into debt a like sum for a like purpose, and those of Meade, Medicine Lodge, Arkalon, and Garden City followed suit, the amount of each city's bonds ranging from $40,000 to $75,000. The machinery

for each will come from Fort Scott, whose foundrymen were not among those who predicted failure, although they knew perfectly well that the experiments at the Fort Scott mill had not been successful.

The mills were finished, the cane crop was harvested, and all agricultural Kansas awaited impatiently the result. It has just been announced. Very little of the vast quantity of cane grown reached maturity. It was dwarfed, and it lacked the sugar producing qualities. The Liberal mill closed October 15th, after having run about 700 tons of cane. The products of sugar did not reach 3,000 pounds, and of syrup there were only 6,000 gallons. About 1,700 acres of cane were cultivated by contract, and probably 300 acres more were put in with the expectation that the mill would be able to use it. What is true of the Liberal mill is true of those of Arkalon, Meade, Garden City, and Medicine Lodge, except that more work was done at Liberal, and its showing is most favourable. A few days ago the Attica Sugar Works went into the hands of a receiver, its liabilities being about $70,000. Financially, the other mills are but little better off. Each had an acreage of cane planted sufficient to keep it busy during the season, but not enough good cane was raised at all of them to have kept one mill supplied. To increase the misery of the situation, the Topeka mill, which had contracted for several thousand acres of sorghum, burned a short time ago, and the farmers were left with no means of disposing of their product. Many suits have been begun against the Company.

Now that disaster has come, the sufferers are extracting what comfort they can from a discussion of the alleged causes. Some declare that late planting is at the bottom of the failure, others that the season was too dry, others that it was too wet. The probabilities are that after the chemists and the State Board of Agriculture submit their reports on the subject, the sugar cranks will accept some one of the many theories put forth and prepare for another season's outlay of time and money. This plan may be followed for several years yet, but eventually all will have to acknowledge that the season in Kansas is too short to make sugar-producing cane in quantities sufficient to build up a great industry. That is the inevitable out-come of the situation.

CUBA.

We append copious extracts from the last Consular Report issued by the Foreign Office on the state of trade and agriculture in the Island of Cuba, including the sugar production :—

Succeeding to a protracted period of trade depression and disaster, the comparative prosperity of the year 1888 in the Island of Cuba would be more cheering to record, did it not result from the satisfactory sugar season rather than from causes calculated to inspire confidence in the prospects of Cuban commerce as a whole. The advance in prices for sugar, however, was largely due to accidental circumstances, such as the backwardness of the beet-root crop in Europe, coupled with the increase in the consumption of sugar throughout the world, which enabled holders of cane sugar in this island to dispose advantageously of their stocks. The market, on the other hand, was controlled by the course of foreign consumption, and prices advanced or receded according to fluctuations in London and at New York, without any reference to the stocks disposable at Cuban ports. While, therefore the importance of the sugar operations must not be underrated, as having at least saved this colony from another acute commercial crisis, the actual results of the past year should be estimated with due regard to the conditions of other branches of trade; and, judging from such statistics as are attainable, it is not possible to point to any material change for the better, although hopeful signs are not wholly wanting.

Statistics, however, are not less fragmentary now than in former years. Those published with official sanction, though, doubtless, sufficient for the purposes of the Spanish authorities, do not supply the data required by foreigners in accurately estimating the trade of the island; and the facts bearing on the commercial relations of Cuba with Great Britain are especially difficult to ascertain, owing to the conditions under which the carrying trade is at present conducted. The figures given in this report are, therefore, to be taken only as approximate. They are derived partly from published official or semi-official statements, and information courteously supplied by public departments; but in most cases it has been necessary to rely on the estimates of private experts, the value of which is somewhat impaired by the wide divergence of views existing among persons of apparent equal experience and means of information. Thus the

average yield of tobacco has been variously calculated at amounts ranging from 500,000 to 1,000,000 bales of leaf and 1,000,000 to £20,000,000 cigars; and the income of the colony at £11,000,000, at £16,000,000, and at £20,000,000 per annum.

As regards colonial finance, the highest and the lowest of the foregoing estimates may safely be rejected. The former has gained publicity chiefly through foreign newspapers, by which the condition of Cuba, social, commercial and political, has, for an obvious purpose, been pronounced beyond repair; and, so far as it may seem to be supported by statistics, takes no account of the circumstance that Cuban owners are rarely inclined to overstate the value of their property in making the returns required of them for purposes of taxation. But taking £16,000,000 as the net income of the island from all sources, the outlook is far from reassuring. In 1888 the taxes, direct and indirect, amounted to about £5,000,000, to which must be added a sum of £1,600,000, levied in local taxation by the 153 municipalities of the island; and there was a deficit in governmental expenditure of more than £600,000. The colonial debt amounts to some £37,200,000, and to meet the annual interest on this £1,800,000 is set aside. These burdens have to be borne by a population of £1,500,000, of whom about 600,000 are negroes or mulattoes. Some years since the Cuban budget showed a total of about £8,000,000 per annum, and the gradual decrease by which it has reached its present amount is stated to be due to the practical impossibility of collecting the taxes.

The customs revenue for 1888 can hardly be said to have been satisfactory. While it shows an increase of £106,448 on that obtained in 1887, it is considerably below that for 1886, which reached the total of £3,185,377, and that for 1885, which amounted to £2,879,741; while it exceeds by only £12,000 the collections of 25 years ago. From the year 1864, during which the Cuban custom-houses received £2,418,631, the amounts steadily increased until they reached, in 1877, a total of £4,709,114, and from that date again decreased until 1882, when a slight improvement took place. In 1884, however, owing to considerable reduction in import dues, as well as to the general stagnation in trade, receipts again began to decrease, and in 1887 the revenue realised was less by £861,161 than in 1886. The improvement which the return of £2,430,664 for 1888, as against £2,324,216 for 1887, appears to indicate, must not be too much relied on, in view of a further change in the import duties effected by the

Royal decree coming into force on July 1st, 1888, under which vessels of nations having treaties with Spain are no longer subject to tonnage dues on entering Cuban ports, but are, in lieu thereof, charged 4s. per ton on the gross weight of all imports and exports carried by them; while non-treaty vessels are required to pay this charge in addition to the tonnage dues formerly levied upon all foreign ships alike. It is estimated by competent judges that, but for this new source of income, the customs revenues for 1888 would show a falling-off rather than an increase when compared with those of previous years.

Judging from the state of the money market, the solvency of the island is hardly more than superficial. A widely prevailing impression that in Cuba there are no planters' or farmers' banks, from which money can be borrowed on mortgage, is not well-founded; but it is the fact that sugar-growers often find it impossible to furnish such security as would be accepted by the two banks still operating in Havana, and have no resource but to hypothecate their crops to advance agents, who afterwards harass their clients by forcing repayments at inconvenient times. The Spanish Bank ("Banco Español de La Habana") and the Commercial Bank ("Banco del Comercio") advance money on first-rate security only, and usually at high rates. There is not, however, a single Cuban bank in which money can be placed at interest, nor a savings bank in which the artisan or the labourer may deposit his earnings. Broadly speaking, banking, as it is understood in England, does not exist in Cuba.

In addition to the banks, properly so-called, there are a number of commercial houses by which certain banking transactions are effected. "Banqueros," however, are in fact exchange agents, rather than private bankers, their principal business being the purchase or sale of bills and drafts for transmission to Spain or to foreign countries.

The colony is still unprovided with a gold or silver currency of its own, and the "paper dollars" in use at Havana and a few neighbouring towns are not the least of the financial difficulties of the island. To meet the calls incident to the civil war, the Spanish Bank issued notes far in excess of its capital, and these were for some years received as equivalent to payments in specie. But when at length it transpired that the bank had not the guarantee, but merely the moral support of the Government, the notes suffered rapid depreciation, and serious loss was entailed alike on commercial

and other banking houses. This depreciation has steadily increased, until at present the Spanish "centén" (of which the fixed value in Cuba is 5·30 dol. gold, or 5·85 dol. silver, or about 19s. 10d.) will buy 12·50 dol. "billetes," or bank bills. These "paper dollars," which are used for the smaller transactions of common life at Havana, Matanzas, and Cardenas, but which are not accepted in the south and east of the island, are nominally payable in specie on demand, but the bank no longer recognises this obligation except in the case of notes of 100 dol., par value, issued within the last few years. For some time an annual charge was made in the budget for the redemption of these notes, but it is not known to what extent the proposed recall was carried out, and for the present all attempts in this direction appear to have been given up. For all important commercial transactions, for the payment of taxes and other governmental dues, and of salaries and house-rent the "paper dollar" is not accepted, even by the bank issuing it, when receiving payment of taxes. The gold in use is mainly Spanish, the modern "centén" having to a large extent taken the place of the "onza" (value £3 8s.) and the "doblón," or doubloon (value 17s.)*; but Spanish bank notes do not make their way here. American silver and bank bills are at about 10 per cent. premium, and Mexican silver (which is largely used) at 20 per. cent discount. English gold is rare, and does not realise full value, the sovereign being accepted as equivalent to a "centén" only. Various proposals have been made for establishing a Cuban currency, and it seems clear that if the notes of the Spanish Bank are to be called in their place must in some way be supplied. But how all this is to be effected is a financial problem, the gravity of which will be more fully appreciated when it is added that the notes at present in circulation represent, nominally, £8,000,000, or, according to common report, nearly double that amount.

Cuba depends for existence solely on the produce of its own soil, but the abundant resources of the island in minerals and agriculture are as yet very partially developed. Hardly more than one-tenth of the whole area—say 4,300 square miles, out of 43,000—is really under cultivation; the rest is either covered with forests, or unreclaimed, or practically unexplored, and much land, which is nominally in the hands of proprietors, is actually unfenced and untilled. Efforts are being made to amend this state of things, and

* In Spain the "onza" is equivalent to 16 dol. only, and the "doblón" to 4 dol.

the mineral wealth of the south-eastern province is no longer neglected. But time and capital are needed if the island, which now supports, in want or in difficulty, a decreasing population of a million and a half, is to be enabled to maintain in comfort—as a country so favoured by nature well might—five times that number. At present the iron mines of Santiago de Cuba are prospering; Cuban wood finds its way to the markets of London and the United States; new potatoes are supplied (out of the American season, and therefore at considerable profit) to New York, and there is a brisk export of fruits of various kinds; sponge fisheries compete successfully with those of the Levant; and the new fibres industry gives good promise. But these exports are still in their infancy, and though much may be expected from them if enterprise be not paralysed by premature or ill-balanced taxation, the island depends as before on only a few important articles of export.

Among these, coffee can hardly now be reckoned, the "cafetales," or coffee plantations, having been so far superseded by the "ingenios," or sugar estates, that the produce of the former does not supply home wants, and coffee is now to be reckoned among imports rather than exports. That tobacco has come to be more appreciated as a reliable source of revenue has been pointed out in a recent Consular report;* but the value of the tobacco crop is, as yet, on the most liberal calculation, no more than £6,720,000 per annum, and the export is necessarily much less. In spite of the difficulties, past and present, connected with competition of cane-sugar with beet-sugar, the sugar export remains, and must for many years remain, the chief source of support to the island. How to make this a paying product is the problem of the present, and, if it cannot be satisfactorily dealt with, the latent insolvency of the colony must assume an acute form.

SUGAR.

To this task, however, planters have applied themselves during the past year with some success. The crop in 1887-88 was good, and if the yield was less than had been predicted at the beginning of the season, it was still in excess of that for the year before. Along with the advance in prices, which was fairly sustained from the commencement of the year, a further saving in the cost of production was effected by means of more careful cultivation of the cane; with the

* No. 115, Miscellaneons Series of 1889.

result that a larger quantity of sugar was extracted at a comparatively smaller expense.

The adoption of the Central Factory system has been for some years an accomplished fact, and its obvious advantages (which were described in the Consular report for 1886) have won for it increasing popularity. Last year it came into operation both on newly-formed estates, especially on the southern coast, and on older plantations, and it seems probable that all planters will in time be compelled to establish it, or, if unable to do so, to give up grinding altogether and sell their cane, as many of them do at present, to the nearest central factory. The system, however, cannot be at once developed to any large extent, owing to the defective means of transit in the interior, where railways are few, roads mere tracks, and canals or navigable rivers non-existent.

Besides economising labour and wages, the setting up of modern machinery has led to increased production of sugars of the better classes; and for some seasons past centrifugals have been by degrees degrees taking the place of muscovados. Last year, especially, many growers abandoned entirely the production of the inferior sugar, and set up centrifugal and treble effect apparatus to produce sugars of the superior classes; and it is more than probable that in a few years the entire crop will be turned into centrifugals.

For the first six months of the year the weather was exceptionally fine, and although it was feared that the drought prevailing early in the season might injuriously affect the yield of the sugar crop, these anticipations were not realised. On some upland estates, indeed, grinding operations had to be suspended as early as March, and it was found that the cost of production exceeded the market price of the produce; but, as a rule, grinding suffered but slight interruption, and although the crop was taken off earlier than is customary, all the cane was ground, none being (as too often happens) left in the fields.

These results, however, were not obtained without much difficulty, owing to the great scarcity of field labourers, which was keenly felt throughout the year. On all sides, too, planters complained that the available men, having the matter practically in their own hands, demanded wages out of all proportion to their labour and the possible profits from the crop.

Satisfactory as was the sugar harvest for last year, much greater results were expected from that of 1889. In August, 1888, rain was abundant, and the cane promised well, more especially in the pro-

ducing localities, in which great care had been devoted to its cultivation, and had attained a development unprecedented at so early a period in the season. A large yield was looked for, and in view of the extension given to planting it was calculated that an increase of not less than 20 per cent. over last year's crop would be realised.

The terrible cyclone which swept over the island on September 4th put an end to these bright prospects. Over 100 plantations, in the districts of Remedios, Sagua la Grande, Cârdenas, and Matanzas, were destroyed, and enormous injury was inflicted on the sugar interest generally. It is too soon to estimate accurately the results of this disaster, but it seems more than probable that, instead of an increase of 20 per cent., the crop for 1888-89 will exhibit a deficit of at least that amount.

In 1888 the prices were not only sustained, but ranged higher than in any year since 1883, owing to the steady increase in the consumption of sugar, which is stated to have last year exceeded the total production of both beet and cane sugar by some 200,000 tons; and it is probable that prices for the latter would have improved still further, but for the unfavourable influence exercised on Cuban trade by the Refiners' Trust at New York. The following table gives the extreme prices for 1888 and the five years preceding*:—

Year.	Special Classes for Spain.	Clayed. No. 12.	Centrifugal 93-97 Test.	Molasses Sugar. 83-90 Test.	Muscovados. 85-91 Test.
	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
1888	2 10½ to 4 3	2 11 to 3 9	2 7½ to 4 1½	1 11¼ to 3 0¾	1 11½ to 2 10½
1887	2 7½ 3 9	2 3 3 4½	1 11¼ 3 4½	1 5¼ 2 8¼	1 4½ 2 7½
1886	2 6 4 0	2 1½ 3 6	2 1½ 3 3	1 4½ 2 6¾	1 6 2 6
1885	2 10½ 4 1½	2 3 3 4½	2 1¼ 3 8¼	1 6 2 8½	1 7½ 2 7½
1884	3 10½ 5 3	2 1½ 3 4½	2 2½ 3 7½	1 1½ 2 6	1 4½ 2 10½
1883	4 10½ 5 6	3 9 4 9	3 1½ 4 7½	2 7¼ 3 10¼	2 9 3 9¾

The following table compares the average prices during the same period:—

Year.	Special Classes for Spain.	Clayed. No. 12.	Centrifugal. 93-97 Test.	Molasses Sugar 83-90 Test.	Muscovados. 85-91 Test.
	s. d.	s. d.	s. d.	s. d.	s. d.
1888 ..	3 6¾	3 4	3 4½	2 6	2 5
1887 ..	3 2¼	2 9¾	2 7¾	2 0¾	2 0
1886 ..	3 3	2 9¾	2 8¼	1 11½	2 0
1885 ..	3 6	2 9¾	2 10¾	2 1¼	2 1½
1884 ..	4 6¾	2 9	2 11	1 9¾	2 1½
1883 ..	5 2¼	4 3	3 10½	3 2¾	3 3¼

* The "real fuerte" being taken at sixpence.

SUGAR PRODUCTION 1879-88.

The annual production of sugar in Cuba has been variously estimated; but the following calculations may be taken as giving a fair idea of its amount and fluctuations during th last 10 years:—

Year.	Sugar.	Molasses.	Total.
	Tons.	Tons.	Tons.
1888.. ..	656,719	157,791	814,510
1887.. ..	646,578	153,015	799,593
1886.. ..	731,723	187,064	918,787
1885.. ..	631,967	146,984	778,951
1884.. ..	558,987	115,552	674,539
1883.. ..	460,397	100,292	560,689
1882.. ..	595,837	131,224	727,061
1881.. ..	493,764	96,747	590,511
1880.. ..	530,189	114,223	644,412
1879.. ..	670,225	146,341	816,566

For molasses the demand at Havana was moderate when the market opened in January, prices ranging from 1s. 7½d. to 2s. per keg of 5½ gallons, according to class, for lots on the spot. In the country a fair number of contracts were closed at from 42s. to 72s. per hogshead of 175 gallons, according to place and time of delivery and cash advances. In February and March quotations fluctuated between 1s. 6d. and 2s. 1½d. per keg, and receded in May to 1s. 3d., at which price the remainder of the stock was bought by local distillers. After this, prices for lots on the spot ruled nominal until the end of the year. In September, first contracts for future delivery were reported at prices ranging from 36s. to 40s. per hogshead, and, business being brisk, prices advanced until November, when 74s. was touched. In December they receded to 68s. per hogshead; but the market closed active and strongly supported at this quotation. Extreme prices paid were, last year, 1s. 3d. to 2s. 1½d. per keg of 5½ gallons, as against 1s. 0¾d. to 2s. 1½d. in 1887 for parcels on the spot; and for future delivery 36s. to 74s. in 1888, as against 40s. to 100s. in 1887.

BRITISH CAPITAL IN CUBA.

From what has been said it will appear that in the production of sugar and tobacco, not to mention less-developed industries, a fair field is open in this island for British enterprise. During the past year, as already reported by Mr. Consul-General Crowe,* nearly

* Miscellaneous Series No. 115.

£1,000,000 of British and colonial capital has been invested in the cigar and cigarette trade by the recently formed Partagás Company (Limited); and the Henry Clay and Bock Company, of London; and the Manilla, New York, and Havana Company of Melbourne; and it is commonly reported that similar investments are likely to be made in the sugar industry before the close of the year 1889. Should this be the case, the new departure would probably be regarded favourably by Spaniards and Cubans alike—whatever surprise or uneasiness it might give rise to among competing capitalists from other countries—as it is fully understood that the interests of Great Britain in this island are of a purely commercial character, and that their development can, therefore, tend only to the promotion of social order and the security of property. What is chiefly wanted to restore commercial prosperity to Cuba is the introduction of capital from abroad in such a way as to open new fields to native industry, rather than to risk the transfer of remunerative labour to foreigners. In the case of the culture and preparation of tobacco it is clearly the interest of investors not to replace experienced native management and labour by foreign and unskilled hands; and the same thing is hardly less important in the case of sugar production. The sugar-growers have struggled manfully to surmount the difficulties of their altered position, and what they now require, in order to succeed, is just such aid as British capitalists might afford them, without losing sight of their own interests. Cubans are by no means deficient in intelligence or business capacity, though not possessed of the industry and method of the Anglo-Saxon traders; and it seems probable that commercial combinations in which British capital and caution should have command of Cuban quickness and experience would lead to results satisfactory to both investors and employed.

ECONOMICAL SUGAR CARRIERS.

We have been favoured with a copy of the following paper, read at a meeting of the Georgetown (Demerara) Royal Agricultural and Commercial Society, by Mr. W. Price Abell, and are glad, in view of its general interest to sugar manufacturers, to give it a place in our columns:—

Little drops of water are as necessary to the mighty ocean as successful waste-saving inventions are to the commercial prosperity

of a people. As sugar manufacturers we know well that our own is held not by the adoption of one radical improvement, but by many economies in waste, such as sugar, labour, fuel, &c.

To-day I beg to bring to your notice a simple but effective apparatus for carrying sugar from the centrifugals to the sugar bunk without waste or damage and with a minimum of attention.

Both before and after my arrival in this colony my attention was often drawn to the wasteful and unsatisfactory working of band and screw conveyors, and this led me, some years ago, to take the matter up with the idea of getting over the difficulties that presented themselves.

1. In the case of the band these arose from its total unfitness, in spite of complicated brushes and cleaners, to carry and deliver the moist and often hot and sticky Demerara sugar.

2. There was no arrangement to clean out and liberate either the solid or helical screws, which consequently often became clogged and choked, triturating the sugar, and necessitating its being dissolved and cleaned off with hot water, and sometimes the removal of the whole apparatus from under the centrifugals at a delay and expense that often prevented its being again replaced.

3. Molasses sugar, through its stickiness, cannot usually be carried even by helical screws, hence the whole apparatus had to be hauled from under the centrifugals.

4. Molasses or water could fall through the centrifugal basket when standing, on to the screw or band, thus making the sugar lumpy or sticky.

A brief explanation will show you how these difficulties are overcome. The sugar discharged through the centrifugal basket falls on to the hollow screw which conveys it to the elevator or bunk. The trough can partly revolve on pokers, the withdrawal of which allows one side of the trough to fall to the ground, thus exposing the screw, and liberating the sugar instantly. By raising the box and inserting the pokers again the apparatus is ready for work. All this can be accomplished without either stopping the machines or conveyor. The light tray to prevent the molasses or water falling on to the cured sugar is pushed in by the operator's foot when the machine is not discharged, and drawn out when emptying the centrifugal.

The above arrangement of trough is for two, three, or four machines; for more, another style, with the sides and bottom partly removable, is used in long ranges of centrifugals where it is necessary

to cure two qualities of sugar at the same time. I have arranged either right or left hand or double screws in one trough, divided by a partition which on being pushed over delivers the sugar from each machine into one or other of the conveyors as desired; the requirements here render it unnecessary for me to explain this, but those interested will find a detailed description in any of the patent specifications of this invention. The advantages of this carrier are briefly:—

1. If the sugar by any means clogs the screw, it can be cleaned in an instant, and that without stopping either the machine or screw.

2. Facilitating the cleaning of the screw when the curing is finished and the machines stopped.

3. It does not damage or triturate the sugar.

4. Molasses sugar cannot usually be carried by conveyors, hence the arrangement for instantly lowering the trough to form a back for the men to shovel against when putting the molasses sugar into casks, so doing away with the necessity of hauling out the conveyor and trough, thus saving no inconsiderable expense and trouble.

5. The prevention of molasses or water falling into the cured sugar through the centrifugal baskets.

6. The entire prevention of waste both of sugar and labour, by needing no attention whatever, except in occasionally lowering or opening the trough for cleaning when required.

7. It is thoroughly substantial and reliable, and I learn has never given any of the trouble so invariably experienced with other conveyors.

In conveying some 3,000 tons of sugar on the two first estates to adopt this conveyor no difficulty whatever has been experienced. I also learn from the sole English makers for the British Colonies, Messrs. G. Fletcher and Co., London, that the few already made by them have given every satisfaction.

There is no doubt that the method of delivering sugar into the bunk with the above apparatus effects a not inconsiderable saving in wages, besides the cleanliness resulting from preventing the sugar being trampled and destroyed underfoot. It was simply the conveyor difficulties, already explained, that prevented the adoption of mechanical sugar-carriers long ago.

W. PRICE ABELL, W.S.,
1883 Honours Medalist in Machine Design.

SWEDEN.

We hear from Stockholm that the beetroot sugar industry is developing rapidly, and that if it continues to progress, Sweden will in a few years be able to produce the greater part of her consumption of sugar. In 1854, there was only one beet sugar factory in Sweden, working up 2,847 tons of roots; in 1887, two other factories were set up, working up 83,605 tons of roots. The quantity worked up in 1888 was 92,654 tons. For the present campaign, a fourth factory has been established, and two others are being constructed. The crop this year is extraordinarily abundant, but a medium one as regards sugar, in consequence of the rain in August and September. The four factories are in full activity, and the sugar is of fine quality. The imports are falling off.

REPORT OF THE COMMITTEE OF THE LOUISIANA SUGAR CHEMISTS' ASSOCIATION ON METHODS OF CHEMICAL ANALYSIS.

With a view to the improvement of the present methods of sugar analysis and the elimination of errors in the processes now used in the determination of the constituents of cane juices, syrups, molasses, &c., the Committee on Methods of Chemical Analysis, or the Sugar Chemists' Association, made during the past summer a series of investigations leading to the results herein given.

These investigations were confined almost exclusively to polariscopic methods, especially as regards the determination of sucrose in the presence of invert sugars. As the necessity of double polarization in the analysis of molasses, syrups and immature sorghum and cane juices is almost universally recognised by chemists conversant with the subject, it was deemed advisable to first make some experiments with reference to the correct expression of the formula used in connection with Clerget's method of inversion. The inaccuracy of results obtained by the use of Clerget's original constant of 144 having become apparent in a number of instances, experiments were made to test the correctness of Landolt's revised figure of 142·4. Though it was comparatively easy, with the aid of a freezing mixture, to reduce the temperature of the invert solution used to 0° C., yet there was such a condensation of moisture on the glasses of the

polariscope tubes that it was impossible to make any satisfactory readings of the instruments. The difficulty, too, of maintaining the low temperature of 0° C., with an external atmospheric temperature much higher, suggested the necessity of conducting the experiments in an atmosphere approximating in temperature, as nearly as possible, that of the solution under examination.

Accordingly, through the courtesy of the New Orleans Cold Storage Company, the Committee was permitted to make its investigations in one of their storage rooms, where a constant temperature of about 31° Fahr. was maintained. The sugar used in the experiments was cane sugar, crystallized in unusually perfect rhombic prisms, a normal weight of which, when dissolved in water and made up to a bulk of 100 cubic centimetres at 17·5° C., gave a reading at 17·5° C. of 100, as determined by three independent observers. The normal sucrose solution when reduced to a temperature of 4° C., however showed a reading of only 99·7. Fifty c.c. of this solution were next inverted in the manner prescribed by Clerget, hydrochloric acid to the amount of one-tenth of the volume of the solution being added.

The temperature of the solution having been lowered to about —2° C., it was placed in a polariscope tube provided with a centre tubulure for the insertion of a thermometer. At—1° C. a reading to the left of 42·9 was obtained, which, when corrected for temperature, gave 42·4. At—$\frac{3}{4}$° C. the solution read 42·46; corrected for temperature, 42·34. At—0° C. the reading was 42·35. At+$\frac{3}{4}$° C. the reading was 42·02; corrected for temperature, 42·39.

The solution was next raised by a gentle heat to about 15° C., replaced in the tube, and several additional readings were made, but the temperature fell so rapidly that no satisfactory duplicate results could be obtained. In these experiments accurately calibrated flasks and tubes were employed, the gaugings were made at 17·5° C., and polariscopic readings were made in duplicate, and in some instances by three observers. It was quite noticeable, too, that at the low temperature employed the solutions could be read with a clearness and precision unattainable even at the ordinary temperature of the air. These results would appear to confirm very fully the correctness of the constant 142·4, as obtained by Landolt.

In order to test the effect of the presence of invert sugar, even in comparatively small quantities, upon the direct readings of the polariscope, it was determined to mix varying proportions of a chemically pure invert sugar solution with a given volume of a pure

sucrose solution, and to test the solutions thus obtained by both single and double polarization. Samples from the same lot of chemically pure cane sugar were furnished each member of the Committee, and the subsequent experiments were performed independently in three different laboratories. A normal sucrose solution, prepared by dissolving 26,048 grammes of sugar in water and diluting to a bulk of 100 c.c., was first made up and designated as solution A. A similar solution was inverted as previously described, and gave the following readings, as determined by the respective members of the Committee:—

	Martin.	Bird. Deg. C.	Ross. Deg. C.
		26 at 33·3	27·4 at 30·5
		26 + 16·65	27·4 + 15·25
Corrected for temperature	42·5	42·65	42·65

These results, as corrected for temperature, seem to indicate that the usual compensation of one-half of a degree of the saccharimeter scale for each degree of temperature is a little too high, though near enough for all practical purposes. A standard invert solution, neutralised with sodium carbonate and made up to 110 c.c., was designated as solution B. Portions of the two solutions were then mixed in the following proportions:—

10 c.c. of solution A and 1 c.c. solution B were made up to 100 c.c., forming solution 1.

10 c.c. of solution A and 2 c.c. solution B were made up to 100 c.c., forming solution 2.

10 c.c. of solution A and 3 c.c. solution B were made up to 100 c.c., forming solution 3.

10 c.c. of solution A and 4 c.c. solution B were made up to 100 c.c., forming solution 4.

10 c.c. of solution A and 5 c.c. solution B were made up to 100 c.c., forming solution 5.

10 c.c. of solution A and 6 c.c. solution B were made up to 100 c.c., forming solution 6.

10 c.c. of solution A and 7 c.c. solution B were made up to 100 c.c., forming solution 7.

10 cc. of solution A and 8 cc. solution B were made up to 100 cc., forming solution 8.

10 cc. of solution A and 9 cc. solution B were made up to 100 cc., forming solution 9.

10 cc. of solution A and 10 cc. solution B were made up to 100 cc., forming solution 10.

The solutions thus obtained were subjected to polariscopic tests, the direct readings in two of the laboratories being made in 400 millimetre tubes, with a double compensating Schmidt & Haensch instrument.

The temperatures of the solutions at the time of reading were carefully noted, and are given below:—

RESULTS OF SINGLE POLARIZATION TESTS.

	Martin. Deg. C.	Bird. Deg. C.	Ross. Deg. C.
Solution 1..	9·80 at 30	9·8 at 33	9·75 at 29·5
Solution 2..	9·60 at 29·5	9·5 at 33	9·55 at 30
Solution 3..	9·30 at 29·5	9·3 at 33	9·35 at 30·5
Solution 4..	9·20 at 30	9·1 at 33	9·10 at 30
Solution 5..	8·80 at 29·5	8·9 at 33	8·85 at 29
Solution 6..	8·60 at 29·5	8·7 at 33	8·60 at 29·5
Solution 7..	8·40 at 30	8·5 at 33	8·35 at 29·5
Solution 8..	8·20 at 30	8·2 at 33	8·10 at 29·5
Solution 9..	7·90 at 30	8· at 33	7·85 at 29
Solution 10..	7·60 at 30	8·7 at 33	7·60 at 29·5
Average temperature..	29·80	33	29·6

From the above results it will be seen that for each cubic centimetre of the invert solution B, mixed with 10 cc. of the sucrose solution A, there has been an average decrease in the apparent per cent. of sucrose of 0·24 at an average temperature of 29·8 deg. C., 0·23 at a temperature of 33 deg. C., and 0·24 at 29·6 C. (The quantity of invert sugar in one cubic centimetre of solution B, when diluted to 100 cc., gives an equivalent of ·957 per cent. of invert sugar.) The normal sucrose solution, when inverted and made up to 110 cc. gives a reading in a 200 millimetre tube of 38·5, at 0 deg. C. $\left(\frac{42{\cdot}4}{1{\cdot}1}=38{\cdot}5+\right)$— at 29·8 deg. C. the reading would be $\frac{42{\cdot}4-\frac{1}{2}\,(29{\cdot}8)}{1{\cdot}1}=25$; at 33 deg. C. the reading would be $\frac{42{\cdot}4-\frac{1}{2}\,(33)}{1{\cdot}1}=23{\cdot}55$; at 29·6 deg. the reading would be $\frac{42{\cdot}4-\frac{1}{2}\,(29{\cdot}6)}{1{\cdot}1}=25{\cdot}1$.

Accordingly to one cc. of such a solution, diluted to 100 cc. should give a reading to the left at 29·8 deg. C. of ·25; at 33 deg. C. a reading of ·2355; at 29·6 degrees of ·251; whereas, the experiments indicate that the right handed readings show deviations to the left of

0·24, 0·23, and 0·24, respectively, for each cc. of the invert solution present—a comparatively close approximation of the practical to the theoretical results. In two of the laboratories double polarization tests of the same solutions were made with the following results:—

	Bird.	Ross.	Ross.
Constant used	142·4	142·4	144
	Per cent. sucrose.	Per cent.	Per cent.
1..	10·07	10·07	9·95
2....	9·91	10·08	9·96
3..	9·95	10·08	9·96
4 ...	9·96	10·05	9·92
5..	9·99	10·08	9·96
6....	10·03	10·05	9·92
7..	10·01	10·03	9·90
8....	10·04	10·01	9·88
9..	10·08	9·99	9·87
10	10·12	10·05	9·92

The results given in the first and second columns are obtained by the use of formula $R = \frac{100\ s}{142{\cdot}4 - \frac{1}{2}\ T.,}$ while the figures in the third column are obtained from the old formula $R = \frac{100\ s}{144 - \frac{1}{2}\ T.}$ The average variations from the theoretical percentage with the use of the constant 142·4 were ·054 and ·051, while with the figure 144 the variation was ·076 per cent. Had 400 mm. tubes been employed for invert solutions, as well as in single polarization tests, the discrepancies would have, without doubt, have been much smaller.

In addition to the polariscope determinations given above, the actual amounts, by weight, of invert sugar in the solutions examined were determined by means of Fehling's solution. The following are the results obtained, together with the theoretical amounts of invert sugar contained in the solutions:—

	Theoretical amounts. Gramme.	Amounts obtained by use of Fehling's Solution. Bird. Gramme.	Ross. Gramme.
Solution 1..	·2792	·253	·2531
,, 2....	·4984	·506	·5074
,, 3..	·7476	·7438	·7445
,, 4....	·9968	·9918	·9950
,, 5..	1·246	1·2346	1·244
,, 6....	1·4952	1·5031	1·4854
,, 7..	1·7444	1·7659	1·733
,, 8....	1·9936	2·004	1·952
,, 9..	2·2423	2·2673	2·227
,, 10....	2·492	2·530	2·4697

The alkaline cupric liquor, used in the above determination, was Violette's modification of Fehling's solution, and was standardized by means of a solution of C. P. anhydrous glucose. It will be seen by reference to the above table that approximately one-fourth gramme, or multiple thereof, of invert sugar was present in each of the solutions examined, and that for each one-fourth gramme present in 100 cc. of the solution there was an average lævo-rotary effect of 0·24, 0·23, and 0·24, at the temperatures of 29·8 deg., 33 deg., and 29·6 deg. At lower temperatures it is readily apparent that this influence would be much greater. The result of these experiments, therefore, would seem to indicate the necessity of making due compensation in sucrose determinations for the presence of invert sugar even in small proportions.

The Committee would, in view of the results of the experiments in double polarization, recommend the use of the constant 142·4 in all such determinations hereafter.

Respectfully,

B. B. ROSS, Chairman,

MAURICE BIRD,

W. P. MARTIN,

Committee on Methods of Chemical Analysis.

NOTE.—In determinations of sucrose by inversion, where accuracy is desired, instead of the regular titration, the amount of copper suboxide should be determined gravimetrically according to one of the methods of Tucker.

DIFFUSION IN BRAZIL.

The following are the conclusions arrived at by the Commissioners appointed by the Brazilian Government to report on the results of the application of the diffusion system in Guadeloupe. Whether the information obtained by the Commissioners will lead to any immediate practical results is at present extremely doubtful. We scarcely think the experience hitherto obtained warrants the conclusion that the expenditure of fuel is less than under the old system of extraction by the mill.

Conclusions.

1. The experience acquired at the Duquerry factory with regard to the new process of diffusion applied to the cane, defecation and filtration being effected in the diffusors, proves conclusively the excellence of this system.

2. The juice extracted and clarified by this method is incomparably purer than that obtained by grinding.

3. The treatment of the juice in the diffusors by the employment of lime is perfectly practical, and at once prevents the inversion of the prismatic sugar.

4. The defecation and filtration effected in the diffusors are excellent, and completely do away with the scum, reducing at the same time the quantity of apparatus necessary for the manufacturing operations.

5. The syrup resulting from the diffusion juice is purer than that obtained from the mill juice.

6. The *masses-cuites* have an average yield of 15·3 % of the weight of the cane, which exceeds that which has been hitherto obtained by the process usually employed in the manufacture of cane sugar.

7. The sugar is of excellent quality.

8. The yield in sugar in proportion to the weight and to saccharine content of the cane has been much in excess of that obtained up to now by the use of double grinding and maceration.

9. The number of hands required in a factory working on the new system is less than for one using the mills.

10. The expenditure of fuel, the necessary precautions being taken, will be less with the diffusion process than with the mills, in consequence of a simplification of the operations.

11. The diffusion battery is not exposed to the grave accidents which may occur where mills are used.

12. The cane cutter performs perfectly the work necessary to keep the manufacture properly going, and the knives will work for twelve hours without requiring to be sharpened. They are easily changed without causing any noticable interruption.

A NEW SUGAR ENTERPRISE IN HAWAII.

From the *Planters' Monthly*.

The organization of the "Hawaiian Sugar Company," with a capital of two million dollars, is the principal event of the month. The majority of the stock has been taken by Hawaiian and American shareholders, and being organized under our laws, it will be officered and controlled here. The officers chosen at the meeting called on the 2nd inst., to organize the Company are:—

H. P. Baldwin, of Maui ....President.
G. W. Macfarlane, of Honolulu............Vice-President.
J. A. Hopper, of Honolulu................Secretary.
E. M. Walsh, of Kauai ....Treasurer.
P. C. Jones, of Honolulu ....Auditor.

The Board of Directors consists of the President, Vice-President, Secretary, Treasurer, C. R. Bishop, G. N. Wilcox and R. M. Catton.

The location of this plantation is on the fine plain of Makaweli, lying between the Waimea and Hanapepe rivers, on the lee or south side of the Island of Kauai. We alluded to this enterprise in March, 1888, at the time that Mr. Watson was here and decided to take hold of it, having obtained a lease of the land from the owners for thirty-five years. The term of the lease has since been extended to fifty years, which will render the stock more valuable as an investment. The area of land available for sugar planting is about 6,000 or 7,000 acres, and it is thought that water can be secured, from the two rivers flowing past it, to irrigate the larger part, if not the whole. The land lies sloping towards the south, the best position that could be desired, and the soil is volcanic and of great depth and fertility.

The expense of bringing the water on to the land will be very great, requiring an outlay of about half a million dollars. Surveyors are now at work to ascertain what plans to adopt to accomplish this in the best way. Large iron pipes will probably be used, to act as a syphon in raising it from the valley to the high land. This, of course, will require the best of engineering skill and experience.

The harbour facilities for landing freight are considered good, in all seasons except southerly winds, which occur only during the winter months. It is quite likely that a pier can be run out into deep water,

alongside which steamers can come to load and unload passengers and freight, except only in storms referred to above.

The machinery for this large estate will be furnished by Mr. Watson, of Glasgow, and it will probably be a diffusion plant, though this has not yet been decided on. It is estimated that the plantation will be able to add at least 6,000 to 8,000 tons of sugar to the annual yield of these Islands. This, however, will depend largely on the success attending the elevation of the water from the two rivers. This is one of those enterprises which every well-wisher to the prosperity of Hawaii will rejoice to see commenced and brought to a successful stage. Although others have made investigations and surveys regarding the amount of water and cost of making it available for plantation purposes, yet the credit belongs to Mr. W. R. Watson and G. W. Macfarlane of having secured the franchise and engineered the enterprise to a point which leaves no doubt of its becoming one of the largest and most profitable sugar estates in this group.

WASHING IN CENTRIFUGALS.

In our November number (pp. 578 and 579), we gave a paper on the above subject, read before the Louisiana Sugar Planters' Association. The following letter on the question has since appeared in the *Louisiana Planter* :—

In your paper of October 19th, I notice a discussion by the Louisiana Sugar Planters' Association, of washing sugar in centrifugals. Of course, we must wash our sugars when quality is desired. The natural question then is: How can we do this in a satisfactory manner and with economical results?

In the first place, the sugar boiler must be held responsible in many ways. The better the juice is clarified, and the better the sugar is boiled—neither too high nor too low—the better will be the sugar. The sugar will be so well granulated that it will readily separate from the molasses and make washing scarcely necessary.

When we do wash, however, how shall we do it? Water is the leading agent for this work, but another less extravagant means may be substituted for water. Hot syrup at 20 deg. Beaumé is far better for washing sugar than water. If water be preferred, use it hot, not

cold, as the molasses yields more readily to heat than to cold, and this is especially true with sugar in the rapidly moving centrifugals.

Squirts are no good. A centrifugal of one barrel, two barrels, or even greater capacity, with well boiled and clarified sugar, can be well washed with from one to two quarts of hot syrup, but not thrown in all at once, but at intervals, after testing the moving sugar to see whether or not the molasses is gone; or, as Mr. Dymond said, "we should first see that the sugar is purged," etc.; and after this take your cup and throw the syrup around the spindle. The quick motion will scatter the water or liquid better than any squirt, and break no grain. The result of this simple operation, if properly done, will give the utmost satisfaction,

I should advise the use of syrup rather than water; but if water be used, use it as hot as possible. My reasons for preferring syrup are that water reduces the density of the molasses too much and makes the sugar too small grained. The molasses is liable to become sour from its thinness, and more fuel is needed to reboil it. Think of a sugar house turning out ten or twenty tons of sugar per day, and your centrifugals using, as it seems Capt. Pharr and others do, from one to two gallons of water in each centrifugal, what fine molasses must result! The use of syrup does away with all this.

At times all the washing on earth will do no good. The sugar boiler may then be at fault, but not always. From lack of temper lime the sugar is apt to get sticky, or close as we call it in Jamaica and other West India islands. With such sugar I would suggest that, as soon as the spindle begins to swing out of line, the usual wooden brace be used to hold it in position, and then that steam be turned on around the drum to blow out the molasses. As soon as it is out the spindle will resume its usual position. To make it white, use just half as much liquor as you would had you had good sugar.

Always throw one gallon of liquor, or even one quart, in your mixer or pug mill while at work so as to save the grain.

If an extra quality of white sugar be desired, after adding the liquor or hot water as the wash, take a quart of clear, warm water, mix in it a little washing blue—just enough to show blue in the water—and add to the sugar the same as when washing, and there will be a great improvement.—*West Indian Observer*.

THE NIGGER'S WAIL.

Befo' de wah, when de sugar we made
  Was biled in de ole fashioned kettle,
De grindin' time was a merry-go-round,
  For us niggers, bofe big and little;
But now dese mens, wid de spy glass and chubes,
  Biles de juice in a cast iron drum;
Dey makes all de stuff into crystals and cubes,
  And leaves no merlasses for rum.
    De boss tink he know'
    Mo' dan ebber befo',
Since dem kemmis done show him some nonsense;
    But de niggers say, "Hi!
    We goan all of us die,
For we got to drink whisky in consikence."

American Paper.

THE "SEREH" DISEASE IN MAURITIUS.

It appears from the latest reports that the dreaded *sereh* disease has now in some manner been imported into the Mauritius. Our readers are aware that this disease has produced most disastrous effects in Java, that every attempt to prevent its spread has hitherto failed, the only mode of extirpation being the destruction of the infected canes, and the importation of seed-cane from Borneo. This last measure has likewise failed, the Borneo canes soon showed symptoms of the disease, and attempts are now being made to grow canes from Celebes seed-canes; there seems, however, no reason to expect greater success with these than with the seed-canes from Borneo.

The *Propagateur de l'Ile de Maurice* makes the following observations:—

In order to combat the invasion of the parasite it is necessary in the first place to know its habits and peculiarities. We are at present of opinion that the parasite is propagated not only by the portions of cane which have struck root, but by the soil also of the infected

districts. On the other hand, we do not think that the *Tylenchus sacchari* is propagated in the upper portion of the cane, the plants, if they are free from infected soil. Finally, it appears to us that the parasite requires considerable moisture for its development. After several days without rain, we have frequently found many of them dead in the roots. After a long drought the *Tylenchus* is found in a sporadic state only in the higher regions.

The fact that it loses its vitality after long droughts is corroborated by the following experiments. We have dried in the open air young roots full of the *Tylenchus*, and some weeks later, after moistening, we have examined them. All the parasites were without movement, nor was there any alteration twenty-four hours later.

The Mauritius journal then proceeds to give the following extracts, from the treatise of Dr. Soltwedel, of the non-technical portion of his description of the parasite :—

"In the cane itself we have but rarely found the parasite, and when we have found it, it has always been in that part of the cane which is underground, where it had already been attacked by other parasites. We have never found it in the portion which is above the soil, nor in the stem, in the midst of the leaves. The development of the parasite consequently takes place in the root only; it is there that its whole existence is passed, and it is only when it abandons the root which has been destroyed for a living root that it is found in the soil. We have never found it in any other roots than those of the cane and the sorghum. We have found several varieties of *Tylenchus* in the roots of rice, but up to now we are unable to say with certainty that the *Tylenchus sacchari* was present there. The two sexes occur in equal proportion; they do not differ considerably in size. The length of the female is 77 millim., that of the male 71 millim. The female is 03 millim. broad, the male 026. The trunk, with three protuberances underneath, a distinctive mark of the Tylenchus, is very distinctly seen in this parasite; its length is 013 millimetres."

The Mauritius planters are also experiencing serious trouble from rats, which bite half-way through a cane and destroy it. They are likely to become such an evil that some special measures will probably have to be taken for their extermination.

TOTAL SOLIDS OBTAINABLE PER TON OF CANE.

(From the *Louisiana Planter.*)

Many planters without laboratory or polariscope are desirous of a simple method by which to determine the total solids they may obtain from a ton of cane at any given juice extraction, and so determine the exact amount of waste or gain.

The inquiry as to how this may be done has so frequently been addressed to Mr. H. Studniczka that he has kindly furnished us with the following simple formula for publication:—

One ton of cane at 70 per cent. extraction gives 1,400lb. of juice, and 600lb. of bagasse.

Determine the extractions by measuring the cubic contents of the juice received, and corroborate the correctness of this measurement by weighing the bagasses from the experimental tons of cane.

Ascertain the weight of the liquid gallons of juice, syrup, and molasses by multiplying the standard weight of distilled water, 8⅓lb. per gallon, by the specific gravity. The specific gravity may be obtained from the tables in *Tucker's Sugar Analysis*, where the specific gravities for each degree, Beaumé and Brix, are given.

After having thus obtained the weight of a gallon of juice, one can easily compute the weight of the juice in any of the tanks by simply getting their cubic contents. If the luxury of a Brix saccharometer, which gives the percentage of sugar in sugar solutions, has not yet been indulged in, then the degrees Beaumé may be converted into percentages by estimating them 1·8 per cent. per degree, and thus the solid matter of any liquid gallon may be determined.

Juice testing 9 deg. Beaumé would then contain about 16·21 per cent. solid matter, and from each 100 pounds of such juice one should obtain 16·20 pounds of dry sugar and molasses. Vacuum pan sugars may be estimated as containing 2 per cent. water, and open kettle sugar from 6 to 8 per cent. This will be found sufficiently correct for all practical purposes.

Molasses will contain from 20 to 25 per cent. of water, and this can be ascertained by the Brix saccharometer.

The contained water of the sugar and molasses should be considered, if exact losses are to be ascertained. One ton of cane at 70 per cent. juice extraction, or 1,400 pounds of juice per ton, should, if it contain 16 per cent. solid matter, produce 224 pounds of total solids.

Estimating then the yield of vacuum pan places at 140 pounds of sugar and 84 pounds of molasses per ton of cane ground, the contained water of the sugar and the molasses would amount to, say, twenty-two pounds, making the product from a ton of cane, say, 246 pounds of commercial vaccum pan sugar and molasses. This should be obtained in case there were no loss whatever in the process of manufacture. Open kettle houses would need to add a still greater amount for the water they contain.

Be sure to let the juice stand fifteen minutes before using the Beaumé or Brix saccharometer, as the air must pass out of the juice before an accurate observation can be made.

ON SEED CANES.

Report of a Committee of the Hawaii Planters Company, presented at their Annual Meeting, October 28th, 1889.

Your Committee, in presenting their report beg to remark that the subject has received such thorough and lengthy discussions at our meetings and through the press, that we find but little to frame a report upon, beyond what has already been seen, said, and heard.

Our report will therefore be (unavoidably) composed in part of old news.

The varieties of seed cane, as far as we know, are as follows :—

1st. Plant cane from ten to twelve months old. 2nd. Ratoon cane about ten months old (not tasseled). 3rd. Tops of either plant or ratoons (not tasseled). 4th. Lalas of either plant or ratoons of sufficient growth to make good seed.

The above comprises the varieties of seed cane used by our island planters, and opinions are much divided as to the best of the above named varieties.

Plant cane of the above named age, of medium size, joints of about three inches apart, with well developed eyes or buds, is by many considered the best for seed, and certainly is excellent seed, but in planting care must be taken not to plant too deep, two inches of soil is sufficient covering for such cane. Deeper planting often results in its rotting; but *no* seed will give a prettier, stronger, or more even start and stand of cane, if proper care is exercised in its planting.

First or second ratoons of vigorous growth, of the age above named,

are by others considered the best—giving as their reasons—that it is hardier, that its eyes or buds are usually more developed, that it is less liable to rot than plant cane, from the fact that it usually contains less moisture and more fibre, and that it is surer in starting under trying conditions of weather. We agree that such a kind of ratoons is good seed, generally.

Tops of either plant cane or ratoons are by others claimed to be the best—and give as their reasons—that they are the vigorous and live parts of matured cane, having thoroughly developed eyes or buds, and containing moisture and fibre of sufficient proportions to insure a good start and stand of cane, under ordinary conditions and styles of planting.

Another thing claimed in favour of tops is, that they take away *no part* of the crop for seed, which is quite correct. It is more expensive collecting sufficient tops to plant an acre of land than to cut the same amount of cane from plant or ratoons, yet the difference, on the whole, will be in favour of the former; as we contend: First, that tops are excellent seed; and secondly, that in cutting off sufficient top from canes (being harvested for manufacture) for seed cane, less trouble is met in the boiling house, and better and more sugars are made from the same cane. Unless tops are used for seed, people usually leave too much of the green top to go to the mill, the properties of which are expressed, mix and interfere with the purer juices.

Lalas, or lateral shoots, are by others considered the natural and best seed, and in many instances they have been found to be good, and many use lalas extensively for seed now, and with good results. We are of opinion that lalas from good, vigorous cane are good seed, and might be used successfully.

We would here remark that whether it be plant cane, ratoons, tops, or lalas, the greatest care should always be taken in selecting the seed, from either and all of the varieties, as care is always rewarded by sure and profitable results. It does not follow that any one of the varieties named will always be the best because it was best this season.

One season we may have ratoons or tops that are better than our young plant cane for seed, and perhaps the following season we find on the contrary, that our ratoons and tops of ripe canes are too dry, and our plant is the best; therefore we can only repeat that the best canes we have *for seed*, are the canes we should always use for that

purpose, for we have no other means of preserving and perpetuating the quality and standard of our canes.

To develop the eyes or buds, it has, in some instances, been found of advantage to top the canes intended for seed a week or more ahead of the time of cutting. Again, where water is obtainable, it has been found of advantage to place the seed in water some days ahead of planting.

One thing we many here mention, that in districts where the land rises rapidly from the sea-shore, say in a distance of two miles, and an elevation of 1,500 feet is attained, we have found seed cane to answer well if taken from the upper and planted on the lower lands, and *vice versa*. In this manner a change of soil and atmosphere is realized.

We further beg to remark that fully as much, or more, depends upon the preparation of the soil, location, season, and the proper selecting and planting of the seed as in the variety and quality of the seed to be used.

For example, one person will well and thoroughly prepare his field, have his land worked and fertilized as it should be, ready for the season to plant, the time and favourable rains come, he furrows out his land and plants, in due time he sees his labour and expense crowned with satisfactory and profitable results. Another party pays less attention to the preparation of his land, and is not ready when the season is at its best, but when he considers himself ready, he takes a part of the same seed and does his planting. The result is different, and he feels disappointed and discouraged, and he at once believes there must be something wrong with the seed.

We wish it to be understood that all we have said applies to canes produced on lands without irrigation.

In regard to varieties of cane we beg to report that, as far as we can learn, *no* cane as yet been found (though many varieties have been carefully tried) that excels, or even equals our Lahaina cane in yield of sugars per ton of cane or acre of land.

It has been thought that some varieties of cane might be found to do better on lands of a high altitude, that is to say from 1,000 feet upwards. We may here state that Mr. A. Moore, Manager of the Paauhau Plantation, Hamakua, Hawaii, has made careful tests of several varieties of cane at an elevation ranging from 1,050 to 1,150 feet. The canes grew well, giving a heavy growth on the land, but the juices were not as pure as the Lahaina nor the fibre as full, and did not at all compare with "our old standby," Lahaina. Mr. Moore claims

that the Lahaina would have given as much, and very likely more sugar per acre of cane than did the "Queensland" or "Rose Bamboo" cane, which was the last of the varieties tested. The result is that this season Mr. Moore holds on to the Lahaina cane, planting at still higher elevations. He plants only enough of the other varieties for future use if found necessary or desirable.

With these facts plainly before us it behoves us to exercise every care in the selection of seed cane, and in the preparation of our soils to receive it, as it appears to us the perpetuation of the valuable properties of this excellent cane depends, in a very great degree upon these two important measures.

Respectfully submitted,

W. H. RICKARD, Chairman.

Hawaii, October, 1889.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. THOMPSON, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

16540. A. WOHL and A. KOLLREPP, London. *Improvements in the production of invert sugar.* 19th October, 1889.

17184. T. O. EASTON and A. WATT. *Improvements in or appertaining to apparatus for filtering saccharine or other liquids.* 30th October, 1889.

17637. T. DUGGAN, Liverpool. *Making a non-conducting heat composition for application to steam boilers, steam pipes, cylinders, char kilns in sugar refineries, &c., &c.* 6th November, 1889.

18856. A. W. GERRARD, London. *Estimating the quantity of glucose or grape sugar in fluids.* 25th November, 1889.

19248. R. LOW, Glasgow. *Improved means for heating pans and other vessels for boiling sugar and fruit in making confections and preserves; for extracting juices from meat; and for distilling and like purposes.* 30th November, 1889.

19728. W. THOMSON, J. MYLNE, and J. B. ALLIOTT, London. *Improvements in apparatus for the expression of juice from sugar cane.* (Complete specification.) 7th December, 1889.

20147. W. P. THOMPSON and BOULT, Liverpool and London. (Communicated by Sylvain Touyaron.) *An improved machine for agglomerating and moulding sugar, brick, coal, or the like.* 14th December, 1889.

ABRIDGMENTS.

17339. A. BAUMGARTH, of Messrs. Madgeburg & Co., Sugar Refiners, of Luderburg, Germany. *Improvements in refining sugar and apparatus therefor.* November 28th, 1888. An atomizer fed with compressed air, is used to deliver a measured quantity of water in a fine spray upon the raw sugar in the centrifugal. A little ultramarine may be added to the water. The atomizer nozzle may be guided by hand, or if preferred, by mechanism, such as grooved cams or the like.

18800. J. DEMPSTER, of 49, Robertson Street, Glasgow, Iron Merchant. (A communication from R. Allan, of Demerara Foundry, Georgetown, Demerara, Engineer.) *Improvements in sugar cane mills.* December 24th, 1888. In this mill a small roller is (without the use of the "dumb returner") combined with two large rollers which are placed with their axes in a considerably inclined plane. The small roller is placed directly beneath the top roller. The cane is first pressed between the top and small rollers, and then passes naturally to the space between the top and second rollers, where it receives the final crushing.

34. T. SLAITER, of 56, Maury Road, Stoke Newington, Mechanical Engineer. *Improvements in apparatus for evaporating liquids.* January 1st, 1889. Improvements on a former patent, viz., No. 10493, 1888. This invention appears to relate chiefly to details of construction. The various parts of the apparatus may be more readily inspected and cleaned.

14147. W. P. THOMPSON and Co., of 6, Lord Street, Liverpool; 6, Bank Street, Manchester; and 323, High Holborn, London. (A communication from P. S. Dodge, of Washington, D. C. Attorney.) *Improvements in candy moulds.* September 7th, 1889. A hand mould intended more particularly for use in moulding cream or fondant. It consists of a series of separate bars of india rubber adapted to be laid side by side, and having corresponding cavities or indentations in their proximate faces which form the mould cells when the bars are laid together. Each bar is provided with a longitudinal stiffening rod or plate. When the bars are laid and held together and the

combined series has been used as a mould, the contents may very readily be removed by separating them.

16535. T. GAUNT, of 115, Broadway, New York; and E. H. CLAPP, of Atlantic Avenue, Boston, Mass. *Improvements in apparatus for evaporating, distilling, refining, or concentrating liquids.* November 14th, 1888. This apparatus is especially adapted among other things for concentrating sugar solutions. A series of evaporators is arranged in gradation, whereby the liquor concentrated in one of them may flow evenly and steadily into the next lower evaporator of the series, the said evaporators being also so coupled together that the products of evaporation from the higher evaporator may constitute the heating agent of the next lower one. Between every two evaporators is arranged a "separator," to purify the gaseous products and to trap condensed steam.

15504. J. LAIDLOW, of 98, Dundas Street, Kingston, Glasgow, Engineer. *Improvements in the construction of Weston's Centrifugal Machines.* October 3rd, 1889. The valve or lid which covers the annular opening in the basket bottom, may be lifted up a distance of say 6 inches to allow of clearing out the dried contents. A fixed hook or catch is employed to engage the lid and retain it in its elevated position. The construction of the apparatus is otherwise similar to that described in a former patent, No. 16794, 1888.

GERMAN.

ABRIDGMENTS.

48358. J. N. KRUSE, Stettin. *Process for colouring sugar crystals.* 27th November, 1888. The sugar crystals are treated with a hot blue sugarising solution. This solution acts as a binding medium between the crystal and the blue colouring matter. The only apparatus required for the operation is a vessel with steam-jacket and inclined bottom, in which the sugar is mixed with the blued sugar solution.

48359. A. BEROUMSKY, Schlam, Bohemia. *Saturation apparatus.* 16th December, 1888. A vertical pipeheater, is built into a saturation apparatus, which can be fed with return steam. Spiral shaped pieces move inside the pipes which are fastened to a sieve plate common to all the pipes, by the aid of which these pieces are moved up and down by means of cranks. By means of these pieces, the juice, milk of lime and carbonic acid become intimate by mixed, the carbonic acid is forced to take a circuitous course, and the sludge is

prevented from settling upon the heating surfaces of the pipes. The carbonic acid is introduced underneath the heater by means of a central rotating pipe with distributing arms. A valve is placed in the outlet drain of the apparatus in order, if desired, to enable the work to be carried on under pressure.

48367. L. SCHRÖDER, Czakowitz, near Prague, Bohemia. 14th February, 1889. *Sugar cap shape for loaf centrifugals.* The usual opening for the top of the sugar loaf shape is replaced by a head-piece with fine openings which offers to the sugar during centrifugalling a securer support than the arrangement usually adopted. In order to fill these cap shapes, filling cups with a conical stuffing ring are provided, in which they are fixed.

48676. E. WLODARKIEWRIZ & Co., Warsaw. *Test taker applicable for testing the liquor discharged from centrifugals.* 14th March, 1889. This test takers consists of a small opening fixed perpendicularly in the casing of the centrifugal drum with an inner inclined discharge surface together with a groove fixed in the inner wall, which catches a part of the centrifugalled liquid. Thus the colour of the liquid is continually under observation on its discharge from the centrifugal sieve, and the finishing of the casing process in a given time is rendered possible.

48967. AUGUST SEYFERTH, Auerbach, Hessen. *Process for casing crystals, for example, sugar crystals, by means of paraffin oil or the like.* 8th March, 1889. Paraffin obtained from the paraffin, or yellow oil of the brown coal tar distillation, is taken and mixed with casing liquid till it forms an emulsion which remains for some time unmixed, but on cooling assumes the consistency of butter. This is then mixed with the sugar crystals, centrifugalled, and afterwards cased with paraffin oil. Casing with paraffin oil furthers the mechanical separation of the syrup, without the sugar becoming thereby dissolved.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY TO NOVEMBER 30TH.

Board of Trade Returns.

IMPORTS.

RAW SUGARS.	QUANTITIES.		VALUE.	
	1888.	1889.	1888.	1889.
	Cwts.	Cwts.	£	£
Germany	4,468,528	5,370,925	2,913,198	4,228,703
Holland	259,707	406,416	166,924	36,984
Belgium	584,750	1,046,620	371,381	695,261
France	23,802	298,339	17,359	218,667
British West Indies & Guiana	2,017,144	1,697,798	1,614,579	1,613,343
British East Indies	993,937	1,701,857	477,585	1,157,411
China and Hong Kong	10,733	45,874	6,420	35,616
Mauritius	255,263	294,282	172,422	287,031
Spanish West India Islands	304,496	49,535	223,544	44,230
Brazil	2,163,085	708,038	1,361,411	505,681
Java	3,496,659	2,278,212	2,607,342	1,960,312
Philippine Islands	706,425	1,023,249	337,604	605,759
Peru	456,065	644,656	338,569	525,028
Other Countries	648,069	646,111	473,141	566,927
Total of Raw Sugars	16,388,672	16,211,912	11,081,477	12,780,953
Molasses	336,448	318,082	105,847	139,846
Total Sugar and Molasses	....	....	11,187,324	12,920,799
REFINED SUGARS.				
Germany	2,595,744	3,684,048	2,264,583	3,732,487
Holland	1,284,975	1,228,783	1,163,386	1,243,997
Belgium	176,295	214,726	168,015	226,650
France	1,197,337	2,196,936	1,058,348	2,158,679
United States	40,498	10,040	37,920	9,759
Other Countries	397,412*	631,500*	316,298*	632,857*
Total of Refined	5,692,261	7,966,033	5,008,550	8,004,429

EXPORTS.—REFINED SUGARS.

	1888.	1889.	1888.	1889.
	Cwts.	Cwts.	£	£
Sweden and Norway	69,612	80,868	57,628	70,942
Denmark	96,634	128,534	71,060	97,249
Holland	84,289	91,845	61,014	74,532
Belgium	29,297	25,935	19,932	19,455
France	6,982	6,282	4,882	4,935
Portugal, Azores, & Madeira	74,845	84,604	53,502	66,675
Italy	84,012	98,034	62,130	82,165
Other Countries	189,644	155,040	147,662	135,161
Total of Exports	635,315	671,142	477,810	551,114

* Imported almost entirely from Russia.

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of November, 1889, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1886, 1887, and 1888, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"LUMPS AND LOAVES."							"OTHER SORTS." Including Crushed Loaf, Granulated, Crystallized, &c.							TOTAL.						
	Monthly Average.				Nov.	Nov.	Nov.	Monthly Average.				Nov.	Nov.	Nov.	Monthly Average.				Nov.	Nov.	Nov.
	1886	1887	1888	1889	1887	1888	1889	1886	1887	1888	1889	1887	1888	1889	1886	1887	1888	1889	1887	1888	1889
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France.............	1462	1363	1686	2212	1087	2121	4582	2688	5099	4855	7772	11707	17543	24214	4150	6462	6541	9984	12794	19664	28796
Holland	3508	3780	3267	2306	3590	3224	2852	1428	2483	2675	3278	3629	2986	4930	4936	6263	5942	5584	7219	6210	7782
Germany & Austria ..	990	1347	1510	2513	1315	1922	2619	6634	10463	11729	13322	13224	11952	18927	7621	11810	13239	15835	14539	13874	21546
Belgium	344	592	622	757	896	507	738	113	308	227	217	370	123	290	457	900	849	974	1266	630	1028
United States	854	454	8	..	..	..	..	5078	2804	157	45	11	7	1	5932	3258	165	45	11	7	1
Russia.............	..	3	..	25	..	..	3	3412	452	1959	2197	349	292	44	3412	455	1959	2222	349	292	47
Other Countries	..	..	1	261	..	..	..	9	15	2	387	..	10	..	9	15	3	648	..	10	..
Total	7158	7539	7094	8074	6888	7774	10794	19362	21624	21604	27218	29290	32913	48406	26520	29163	28698	35292	36178	40687	59200

SUGAR STATISTICS—GREAT BRITAIN.

TO DECEMBER 21ST, 1889 AND 1888. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS. 1889.	STOCKS. 1888.	DELIVERIES. 1889.	DELIVERIES. 1888.	IMPORTS. 1889.	IMPORTS. 1888.
London	48	30	312	299	334	282
Liverpool ..	82	95	302	320	288	328
Clyde......	41	25	236	244	256	227
Bristol	3	3	56	52	56	50
Total ..	174	153	906	915	934	887
	Increase.. 21		Decrease.. 9		Increase .. 47	

SUGAR STATISTICS—UNITED STATES.

(From Willett, Hamlen & Co.'s Circular.)

FOR THE FOUR PRINCIPAL PORTS. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND. FOR NOVEMBER, 1889 AND 1888.

	STOCKS. December 1st. 1889.	STOCKS. December 1st. 1888.	DELIVERIES. In November. 1889.	DELIVERIES. In November. 1888.	IMPORTS. In November. 1889.	IMPORTS. In November. 1888.
New York	11	32	48	45	31	32
Boston	1	6	2	5	1	5
Philadelphia....	..	—	20	6	20	7
Baltimore	..	..	..	..	..	..
Total......	12	38	70	56	52	44
	Decrease.. 26		Increase.. 14		Increase .. 8	
Total for the year			951	987	951	977

NEW YORK PRICES FOR SUGAR.

From Willett, Hamlen & Co.'s Report, December 14th, 1889.

FAIR REFINING.	96o/o CENTFS.	GRANU-LATED.	STAND. A.	STOCK IN FOUR PORTS.
Dec. 19, 1889.—5¼c.	6c.	6¾c.	6½c.	Jan. 1, 1889— 32,254 tons.
Dec. 20, 1888.—5¼c.	6¼c.	7¼c.	6⅞c.	Jan. 1, 1888— 47,798 tons.
Dec. 22, 1887.—5⅝c.	5 15-16c.	6⅞c.	6½-9-16c.	Jan. 1, 1887—102,279 tons.
Dec. 23, 1886.—4⅝c.	5⅝c.	5 11-16-¾c.	5⅝c.	Jan. 1, 1886— 57,328 tons.
Dec. 24, 1885.—5½c.	6¼c.	6¾c.	6¼c.	Jan. 1, 1885— 89,186 tons.
Dec. 18, 1884.—4¾c.	5 5-16c.	5⅞c.	5½c.	Jan. 1, 1884— 60,900 tons.
Dec. 20, 1883.—6 3-16c.	7 1-16c.	7⅞c.	7⅝c.	Jan. 1, 1883— 50,297 tons.
Dec. 21, 1882.—7c.	7 11-16c.	8¾c.	8¼c.	Jan. 1, 1882— 43,927 tons.
Dec. 22, 1881.—7⅜c.	8 1-16c.	9 3-16-¼c.	8¾c.	Jan. 1, 1881— 66,999 tons.
Dec. 16, 1880.—7⅝c.	8 5-16c.	9½c.	9⅛-¼c.	Jan. 1, 1880— 63,558 tons.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 30TH NOVEMBER, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	German Empire.	Austria.	Remaining four principal *entrepôts*.	TOTAL 1889.	TOTAL 1888.	TOTAL 1887.
177	166	31	392	214	21	1001	714	877

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 30TH NOVEMBER, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	German Empire.	Austria.	Remaining four principal *entrepôts*.	TOTAL 1889.	TOTAL 1888.	TOTAL 1887.
1312	459	31	428	249	351	2830	2732	2727

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.	1886-87. Tons.
France..........	700,000 ..	466,767 ..	392,824 ..	485,739
German Empire ..	1,220,000 ..	990,604	959,166 ..	1,012,968
Austro-Hungary..	730,000 ..	523,242 ..	428,616 ..	523,059
Russia and Poland.	480,000 ..	537,000 ..	441,342 ..	487,460
Belgium	195,000 ..	145,804 ..	140,742 ..	135,755
Holland	60,000 ..	46,040 ..	39,280 ..	36,098
Other Countries..	60,000 ..	55,000 ..	49,980 ..	49,127
Total....	3,445,000	2,764,457	2,451,950	2,730,206

Mr. Licht's present estimate is, on the whole, again higher than last month by 115,000 tons. Only for Russia does he give a lower figure.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

Prices for cane sugar recovered at the beginning of the month, there being rather a scarcity of good refining qualities, and were fairly maintained, closing all round higher than last month. Demerara crystals were especially in demand. The cane crop for 1889-90 will scarcely equal that of last year. Beet sugars are a little higher, and the tendency is if anything to advance, notwithstanding the large production. Russian crystals continue to be neglected. French loaves are higher. On the whole we have probably seen the lowest prices for most kinds for the present.

A noteworthy feature is the import of considerable quantities of low French beet sugar, chiefly by Clyde refiners.

Mr. Licht has again raised his estimates for the beet crop of 1889-90 owing to the yield per acre being larger than had been expected. The estimated increase on last year will then be some 550,000 tons; against this must be set the certain increase in the consumption. The increase was generally anticipated, and was hence discounted early on.

The imports into the United Kingdom (four principal ports) up to 21st December show an increase, as compared with 1888, of 47,000 tons. Stocks have somewhat increased, being about 21,000 tons greater than at the corresponding time last year.

Present quotations for the standard qualities, as under, are :—

FLOATING.			Last Month.
Porto Rico, fair to good Refining	13/- to 14/-	against	12/3 to 12/6.
Cuba Centrifugals, 97°/° polarization	14/6	,,	14/-
Cuba, fair to good Refining	13/- to 13/6	,,	12/6 to 12/9.
Java, No. 14 to 15 D.S...	15/- to 15/3	,,	14/3 to 14/6.
British West India, fair brown..	12/-	,,	11/9
Bahia, low to middling brown	10/3 to 10/9	,,	10/- to 10/6.
,, Nos. 8 to 9	11/3 to 11/9	,,	11/- to 11/6.
Pernams, regular to superior Americans. .	10/6 to 12/3	,,	10/6 to 12/3.

LANDED.			Last Month.
Madras Cane Jaggery..	9/6	against	8/6 to 8/9.
Manila Cebu and Ilo Ilo	9/-	,,	8/3 to 8/6.

Paris Loaves, f.o.b...	17/-	against	16/6 to 16/9.
Russian Crystals, No. 3, c.i.f.	Nominal	,,	
Titlers	19/-	,,	19/-
Tate's Cubes..	21/-	,,	20/-
Beetroot, German, 88%, f.o.b..	11/7½ to 11/9	,,	11/6 to 11/7½

THE
SUGAR CANE.

No. 247. FEBRUARY 1, 1890. Vol. XXII.

☞ The writers alone are responsible for their statements.

Cheques and P.O. Orders to be made payable to The Proprietor, 6, Ward's Buildings, Deansgate, Manchester. All other communications to be addressed to The Editor, at the same address.

For Table of Contents, see page i.

We give on pages 81 to 88 reports just received of the results of diffusion and other systems on some of the principal sugar plantations in Louisiana. The advocates of diffusion for the cane seem to be confident of the ultimate triumph of the process. On the Magnolia estate (Louisiana) they state that the fuel question does not give them much concern. They throw the chips into the river. On this estate the coal consumption "will not exceed six barrels of coal, of "180 lbs. per 1,000 lbs. of first, second, and third sugars. Considering "that many mill plants which burn the bagasse largely exceed this "figure, anxiety about the expense of fuel need not deter any planter "from going into diffusion."

A claim having been made on the London and North Western Railway Company for damage to two bags of sugar, injured by rats in transit to Crewe, and the company having declined to be responsible, and detained the sugar, it was decided in the Crewe County Court that the company must deliver the two bags to the plaintiff without further charge and pay damages, 10s., with costs in the case.

Messrs. Ruston, Proctor & Co. (Limited), of Lincoln, have been awarded a "special" first class gold medal for their Class M Compound Fixed Engine of Medium Stroke, shown at the late Birmingham Exhibition.

We would call attention to a letter on the sugar question, as connected with Barbados, from the pen of a gentleman of great experience in sugar matters, long resident in that island, which will be found on page 100.

Demerara papers state that the output of sugar for 1889 will closely approach the greatest production on record, which was that of 1884.

The Havana crop is being brought to market, but although the three large central factories at Porto Principe are expected to produce from 18,000 to 20,000 hhds. this year, being about 50 per cent. more than last year, the general crop, owing to the drought, will be inferior to the one immediately preceding. Many large fires have taken place in the cane fields.

Some of the Cuban journals have been advising planters "not to speculate with their sugars, but to sell them as soon as made, at ruling market prices, in order to obtain at the end of the campaign the average of rates paid throughout the season, a scheme that has proved highly favorable to all those who have adopted it and prevented them from suffering the heavy losses befallen those who, on the contrary, held back their produce in expectation of better prices.

"It must be understood that the sugar manufacturing industry is a serious and solid business, quite excluding all sorts of speculative and gambling risks on the part of producers, who should be contented with whatever small benefit offered them, rather than exposing themselves to serious disasters that might injure and weaken their future position."

A company is said to have been formed at Lisbon under the name of the Mozambique Sugar Company, for the purpose of cultivating the cane in the Portuguese possessions in that district. Lisbon bankers and commercial men have started the new enterprise, and anticipate large profits. Sugar imported from Portuguese colonies only pays half the high duties levied on other sugar. The consumption in Portugal is, however, comparatively small, and the probable eventual production of large quantities of beet sugar would seem to make the adventure in Mozambique a somewhat speculative one, as the beet industry is to be favoured by exceptional fiscal legislation.

A short time ago we mentioned the new process of roasting sorghum cane which was being tried in Kansas. The *New York Merchants' Review* is responsible for the statement that the charges against the American Sugar Co., of Meade, Kansas, to the effect that the company have been using cane sugar to assist the production of sorghum sugar by the Adamson roasting process, have been investigated by the

State Sugar Inspector and found to be substantiated by unimpeachable testimony. The inspector thinks the roasting process may possibly prove a success in the future, but deprecates the idea of voting any more township bonds for the purpose of erecting new plants, until the success of the process has been demonstrated beyond doubt.

According to the same paper, the opening of Claus Spreckels' Philadelphia refinery has already had a marked effect on the prices of refined sugars and caused a material falling off of the profits of the Trust. The difference between refined granulated and centrifugals averaged as high as 1·75c. in September last, but in December the average was down to 0·81. Therefore, the public are indebted to Mr. Spreckels' competition with the Trust for a reduction of about 0·94c. per lb. on granulated sugar, as it is highly improbable that the margin between refined and raw sugars would have been voluntarily reduced by the Sugar Trust. The capacity of the Spreckels' refinery is 300,000 tons per annum, and he is reported to be making preparations to duplicate the buildings and plant. A refinery with a capacity of 1,000 barrels a day is building near Baltimore and will be completed before the close of the year. Unless the Trust shall be able to make terms with some of the independent refiners, the present year will no doubt be memorable for the fierceness of the competition among the refiners and the low margin on which they will work. Details of the arrangements of the new refinery will be found on another page.

The wave of resistance to the system of Trusts or Syndicates, which have so long been running wild in America, is now showing itself, as far as sugar is concerned, in a growing determination to attempt to put sugar on the free list. This would probably effectually put an end to the "Trust" monopoly, as far as sugar is concerned. Southern planters, however, find hope in the constitution of the Committee of Ways and Means of the United States Legislature, to which they have addressed a memorial (for which we have not space this month), and think the present arrangement will be maintained.

Prices of sugar Trust shares have of late been rather fluctuating, not to say erratic. It is reported that the change of the Trust into a chartered corporation cannot be made until the decision of the Court of Appeals has been given, probably in February.

After the experience we have had of electrical sugar refining, the following paragraph can scarcely fail to provoke a smile :—

"After repeated experiments, a well known tanner of this city (Havana) has succeeded in discovering an electrical process by which he is able to tan hides of the largest sizes in less than 60 hours. To secure the benefits of his invention he has simultaneously applied for letters patent, both at Madrid and Washington."

Electricity seems just now to be the *Deus ex machinâ* to which all are looking to attain the impossible, which our neighbours across the channel are in the habit, euphemistically, of promising to do.

Some alarm is being felt by the French sugar manufacturers and beet cultivators, in face of the great probability of a further change in the fiscal legislation affecting the article. We long ago pointed out the almost certainty that the French Government could not continue to suffer the heavy drain caused by the existing arrangements, which in themselves are a modification, in favour of the Treasury, of the high protective law of 1884. Readers will probably have noticed the latter part of a paragraph on French Sugar Legislation and Bounties, on page 18 of last month's issue. It now appears certain that the calculations of the French Minister for the budget of 1891 indicate a deficit of about 27,000,000 frs. (£1,080,000) on the head of sugar, and there can be no doubt that the manufacturers will have to submit to fresh charges and a reduction of the excessive bounty which they have been enjoying. Many people on this side of the water will think that an industry which requires such sacrifices on the part of the nation at large is, to say the least, a dear bargain.

The German sugar companies have now nearly all presented their accounts for the 1888-89 campaign. The large refinery at Dessau, which last year declared a dividend of 62½%, has just presented its balance sheet, and will this year pay a dividend of 60 per cent. on its capital of 2,400,000 marks, or £120,000.

From California it is reported that a new beet sugar factory and refinery is being erected at Chino (San Bernadino City), with French machinery. On the other hand, at Anaheim (Orange County) the land owners, mostly Germans, are planning the establishment of a raw sugar factory for beet sugar, for which the machinery will presumably be German.

It is stated that a variety of sugar cane, found on the banks of the Niger, contains 23 per cent. of sugar, but there is at present no means of ascertaining the truth of the report.

At a meeting of the Council of the Workmen's National Association for the abolition of foreign sugar bounties, held in Whitechapel, London, on the 25th January, the secretary reported the result of an interview which a deputation from the Council had had with the Hon. Schomberg M'Donnell, one of Lord Salisbury's private secretaries. Mr. M'Donnell, it was stated, assured the deputation that the Premier had authorised him to state that the Government intended to do everything in their power to secure the ratification of the International Sugar Convention next session. The Council accorded a vote of thanks to the Government.

GERMAN SUGAR PRODUCTION FOR EIGHTEEN YEARS.

The first two columns represent the official figures, the second two those given by the *Deutsche Zuckerindustrie*, which include the sugar obtained from molasses, both in refineries and ordinary raw sugar manufactories.

	Official Figures.		Mr. Herbertz's Figures.	
	Sugar in Tons.	Yield per cent. of weight of beets.	Sugar in Tons.	Yield per cent. of weight of beets.
1871-72	186,442	8·28	186,441	8·28
1872-73	262,551	8·25	262,551	8·25
1873-74	291,040	8·25	291,040	8·25
1874-75	256,412	9·30	256,412	9·30
1875-76	358,048	8·60	358,048	8·60
1876-77	289,422	8·15	290,923	8·19
1877-78	378,009	9·24	380,509	9·30
1878-79	426,155	9·21	430,155	9·35
1879-80	409,415	8·52	415,415	8·64
1880-81	555,915	8·79	573,021	9·06
1881-82	599,722	9·56	622,288	9·92
1882-83	831,995	9·51	848,922	9·71
1883-84	940,109	10·54	960,609	10·77
1884-85	1,123,030	10·79	1,146,730	11·02
1885-86	808,104	11·43	838,105	11·85
1886-87	985,627	11·87	1,023,734	12·32
1887-88	910,698	13·08	959,118	13·77
1888-89	944,504	11·96	990,476	12·55

BRAZIL.

The following arrangements have been made by the Minister of Agriculture for assisting the important sugar industry both as regards the planters and the manufacturers. The want of success hitherto attending the undertakings where interest had been guaranteed as calculated to make us sceptical as to any immediate good result.

A guarantee of 5% interest for 25 years on capital invested in sugar manufacture is to be granted, whether the companies are Brazilian or foreign. Such factories already existing as may introduce the diffusion process are to have a further guarantee of interest. Factories which obtain from the cane twelve per cent. of sugar of all kinds, will receive a premium of from 01 to 20,000 milreis (£2,220 to £4,440).

The first planter who succeeds in increasing the saccharine content of the cane by means of improved methods of cultivation, will also be entitled to a premium of from 10 to 30,000 milreis (£2,220 to £6,660). The maximum amount of capital on which the Government guarantee is to be given is fixed at 3,000,000 milreis (£666,000). This is more than double the amount on which the guarantee has been given hitherto.

The following are the details of the new central sugar factories, the establishment of which the Brazilian Government decided to favour. A German company, Haupt & Co., Rio de Janeiro, is to have for 25 years a guarantee of 6% interest on a capital of 9,750,000 milreis (about £2,165,000) applied in the establishment of ten central factories with distilleries attached. Of these factories, five are to be on the diffusion system, capable of working up 600 tons of cane per 24 hours, each with a guarantee of 6% on 1,200,000 milreis. One of these is to be at Pernambuco, another at Bahia. The five remaining will be able to work up 300 tons of cane per 24 hours. These are not compelled to adopt the diffusion system, and the guarantee of interest is on a capital of 750,000 milreis each.

No interest will be charged on machinery imported by the above company for four refineries which are to be erected at Bahia, Pernambuco, Rio de Janeiro, and Alagvas.

A later decree of the new Government orders that all foreign companies doing business in Brazil must transfer to that country

two-thirds of their entire capital within two years of their organisation. The companies already in existence must do the same within six months.

The present form of government is being stigmatised as a military despotism, and our readers may remember that we referred, when the news of the revolution first reached Europe, to the dangers of military *pronunciamientos*. But we cannot regard the present change as merely brought about by a few individuals, and though we hear of a strict military régime, and the stern repression of at least one reactionary outbreak, it is difficult to conceive of so great a change being permanently established without exceptional powers being entrusted to, and, when occasion served, used by the military under proper direction. We will therefore hope that the country may be spared the terrors of civil warfare, and that the companies above mentioned may be more fortunate than those referred to in the article from the *Stock Exchange*, from which we quoted in our December number, page 825.

ARGENTINE REPUBLIC.

(German Consular Report in the *Deutsche Zuckerindustrie.*)

PROVINCE OF TUCUMAN.—By the issue of a loan of 3,000,000 pesos (gold), the Government has been placed in a position to establish a Provincial Bank for the encouragement and support of industry and manufacture. The loan has benefited above all the much depressed sugar industry, and has lent new life to the cultivation of this principal product of the province. The production of this important article of export was estimated at 2,000,000 arrobas (22,650 tons) for 1888. Every year about 10,000,000 litres of rum are produced.

PROVINCE OF SANTIAGO DEL ESTERO.—There is an encouraging advance in this province in every branch of trade and industry. A loan of 3,000,000 pesos (gold) was obtained through the National Bank in Buenos Ayres, and applied, as in Tucuman, in founding a Provincial Bank, which is well managed and prosperous, and is extremely useful to trade and industry. Effective legislation in every branch of political economy has produced the best effects, and improved the treasury receipts. The population is beginning to take

up agriculture more and more, to which the increase of European immigration no doubt contributes.

In consequence of the bad results of the crop in 1887, the cultivation of the cane in this province has much fallen off; two factories have failed, so that only four are now working, but the year 1888 in consequence of the good prices then obtained which promise to be better in the current year (1889) has wakened up the industry, and an abundant crop may be looked for. The annual production of sugar is about 600,000 arrobas (6,800 tons). The greater part of the sugar produced is consumed in the province itself, a small portion, and also a very good and much liked spirit, the yearly production of which amounts to about 400,000 gallons.

BARBADOS ESTATES AND THE SUGAR QUESTION.

Reprinted from the *European Mail*, January 9th, 1890.

Sir,—Messrs. Travers & Co. (Limited), in their produce markets review, of Saturday, January 4th, refer in their sugar article to a dividend of 27% by the Barbados Sugar Estates Company. They possibly are not aware that the company at present only owns one estate. It was bought in Chancery at, I believe, a reduced valuation from the value at which it would formerly have been appraised. The name of the estate is Oxford. It was bought in February, 1889, so that the company had the advantage of reaping a crop on which they had not expended one penny during the previous fifteen months' cultivation. The crop, too, came in for the good prices ruling under the impression that there would be a sugar famine. Unless the present price of sugar advances I fear their next dividend will be nil, or close upon it. At any rate, the 27% dividend is undoubtedly an abnormal one. We that are interested in the British cane sugar industry have to contend against terrible odds, and against statements which convey a wrong impression.

For instance, in the Financial Reform Almanac for 1890, page 17, we are told "that while the production of beet sugar has increased from 190,000 tons in 1853-55 to 2,433,000 tons in 1886-87, an increase

of 2,243,000 tons, yet cane sugar has also increased from 1,233,000 tons to 2,754,000 tons, an increase of 1,521,000 tons."

On the same page (17) we are told "that the British cane sugar in 1853-55 was 261,000 tons, and in 1886-87 it had increased to 580,000 tons; that *foreign cane sugar* in 1853-55 was 972,000 tons and in 1886-87 2,174,000 tons.

If you add 261,000 tons British cane sugar to the 972,000 *foreign* cane sugar you get the figures 1,233,000 tons as the output of the cane sugar industry for 1853-55; but I contend, (as the 972,000 tons of *foreign cane sugar* was virtually assisted by a bounty, seeing that the continental nations protect the products of their sugar Colonies by imposing a Customs duty on the import of other sugars), that the increase of the foreign cane sugar should not be entered in the same category as British cane sugar. That increase was the difference between 972,000 and 2,174,000, or 1,202,000 tons.

The British cane sugar industry is handicapped on all sides. In America the sugar from the Sandwich Islands is free of duty, while British cane sugar pays some £10 per ton, and more if the quality exceeds a certain standard. In England we are met with bounty-fed beet sugar; on the Continent by a Customs duty, from which the foreign sugars from their respective Colonies are exempt.

We did in Barbados pass a Bill allowing all products from America duty free, provided the United States admitted our sugar duty free.

The United States agreed to the arrangement; but, unhappily for the Barbadians, the Bill was disallowed in England. What would be thought of a father who should say to his son who proposed to leave his business for a higher salary, "I cannot allow it; my arrangements are such that your presence in my office is essential to the wellbeing of my business." "Fair play is a jewel." When will England carry out the precept in respect of her Colonies?

I am, &c.,

W. H. JONES.

1, Vermont Road, Upper Norwood,
January 6th.

P.S.—British cane sugar in 1853-55 was 261,000 tons. It had increased in 1886-87 to only 580,000 tons.

CANE SEED AND SEED CANES AT THE BOTANIC GARDENS, TRINIDAD.

From the *Port-of-Spain Gazette.*

The possibility of the sugar-cane producing seed and of canes growing as freely from the seed as from the traditional shoot is no longer a debatable question. It is an established fact. And sugar planters have to reckon in future with botanical forces that will create nothing less than a revolution in the agricultural department of the sugar industry. We pointed this out about a year ago as the inevitable result by analogy of the discovery of cane seed and seed canes at Dodds's Botanical Station, Barbados. For, botanically, the discovery places the sugar-cane on the same level of possible improvement as its saccharine rival, the beet, and the other plants useful or beautiful of the vegetable kingdom, which the selection of species and scientific culture have advanced on specific lines of utility, so far beyond their original state.

As regards Trinidad planters in the discussion of the cane seed question, they are now in the position of "who runs may read." For at the Botanic Gardens are to be seen cane seeds from Barbado in their natural state in the cane tassel glumes, perfectly visible to the eye and about the size and colour of oat seed; secondly, cane seed with the green radicles and plumules germination also visible to the naked eye, but still more visible with the microscope; and, lastly, two year old canes grown from seed. Mr. Bovell who has sent these specimens to Mr. J. H. Hart, the Government Botanist, is the professional agriculturist who with Professor Harrison has been conducting a series of most interesting experiments in cane planting and cane manuring at the above botanical station. In a letter accompanying these interesting plant specimens, they have informed Mr. Hart that they have now at Dodds's Botanical Station 130 seed canes of two years' growth, and 1,600 seedlings of this year's planting. The fact that Messrs. Bovell and Harrison are able to send to Kew Gardens and the various botanical stations in the West Indies, specimens so clearly establishing the reproduction of the cane by seed, shows that the new culture is in a position now to pass out of the experimental stage into the sugar planter's practical stage of the cultivation. Nothing proves this better than the twelve full grown canes, two of each variety obtained from seeds, to be seen at the Botanic Gardens.

These canes have been cut into six to seven feet lengths, and have the following classification provided for them in the new order of things: I. The Armstrong cane.—Of a glaucous or bluish hoary colour, the frosty coating a peculiarity, and the internodes thick and of medium length; II. The Morris cane.—Of a yellowish green colour, with medium size internodes; III. The Burke canes.—Yellow with blood-coloured patches, with medium size internodes; IV. The Governor Lees cane.—Of a purple colour, with short, stout interlodes; V. The Hart cane (so named from the present Government Botanist).—Internode unusually long—almost nine inches, colour a purplish green; VI. The Watts' cane (grown on the property of that gentleman of racing fame).—Colour greenish yellow, internodes of medium size.

As seen in the microscope, the cane seed, like a true grass seed, has its germinating embryo on the side, and the bottom end of the seed appears to have two small appendages like the twin divisions of a fish's tail.

The cane from which the seeds were obtained for these results came from Mauritius and the East; and to our present Governor, Sir William Robinson, belongs the credit of having imported them into Barbados, for experimental purposes to which he had lent his patronage, during his pro-consulship of that colony. It is therefore to be regretted under the circumstances that none of the varieties have been given his name. This may however be remedied in the future.

These specimens of cane seed and seed canes referred to were viewed and examined by us at a visit to the Botanic Gardens yesterday morning. Our cicerone on the occasion, Mr. Hart, the energetic Colonial Botanist, in whose domain are many things as wonderful, and even more wonderful than the seed and seedlings of that tall grass we call the sugar cane, was kind enough to show us some of the curiosities of his department. First, the herbarium, where the abstract work is carried on of classifying the dried characteristic parts of plants, to which the botanist has added some most useful microscopical work of his own in the organisms and diseases of plants; and where also is the botanical reference library *de rigueur*. Then the nurseries, to which Mr. Hart has made valuable additions and improvements. In the building in which is the botanist's office and herbarium, we were shown the cleaning and shelling machines and the drying barbecue for coffee; two splendid vanillas from Siparia to be sent home; two edible yams, of a shell-like, corrugate shape, the fruit of

a peculiar vine, and the herbarium volumes of dried specimens in their cedar and mahogany presses, a few of which latter were from cedar and mahogany trees grown in the gardens. An imposing array of barometers is to be seen in the botanist's office, besides the one in the grounds, from which the meteorological observations are taken. Not far from the office stood a tall fibre plant, the *Furcræa Cubensis*, or true *Langue Bœuf;* and in the nurseries the *Maholtine*, or *Abutilon Periplocifolium*, whose surpassing merits as a fibre plant the botanist has lately treated in the *Agricultural Record*. A decorticating machine is a superfluous thing in the case of this particular fibre plant, for, cutting off one of the stalks, Mr. Hart, by simply pulling the fibrous coating along the stem had, the ribbons out in all their length, in the twinkling of an eye. The pine-apple plot looked well, also a coffee bed, in which the plants had been readily reproduced from seed. Other economic plants and flowers there were, too numerous to mention; and these, with the effective manner in which the mechanical appliances of cultivation were distributed, showed clearly the zeal and ability of the superintendent of the gardens. We were also informed by Mr. Hart, in reply to a question on the subject, that he had identified as *Roetbollia Exaltata*, the new, strange grass pest which has lately made its appearance in Savonetta and Montserrat, notably at Mr. Fenwick's estate at Mount Pleasant. Its origin is traced to the probable introduction of the seed in the districts affected by large flocks of birds, which were seen some time before to be winging their flight from the south to the interior of the island. The botanist Griesbach ascribes to this pernicious grass a place in the West Indian flora, but it does not seem to have been known in Trinidad until its recent appearance near Montserrat, where its tall, rapid and obstinate growth, far worse than that of Para grass, has struck terror into the hearts of the planters.

We left as deeply impressed with the general usefulness of the Botanic Gardens as an educational factor in the agricultural field of the Colony, as with the particular merits of the cane seed question so practically exhibited there to our view. Time, which is fraught with the important issues of the latter, will bring also, it is to be hoped, the great advantages of the Botanical Gardens, as a model nursery and experimental station, more clearly before the planting public and the rising generation, who will find in scientific agriculture a safer *El Dorado* than in the gold mines of the Guianas.

THE SUGAR INDUSTRY IN GUADELOUPE.

Extract from the Governor's Speech, from the *Sucrerie Indigène.*

The sugar campaign of 1888-89, estimated beforehand in the budget at 110,000 barrels, has only reached 91,000 owing to the defective yield resulting from the drought which prevailed in November and December, 1888, as well as the heavy rains which hindered the in-gathering of the crop. This will result in a deficit in the local budget of 170,000 francs, and of 43,000 francs for the communes; we may, however, congratulate ourselves that the error in calculation, caused by atmospheric conditions which falsified the most legitimate expectations, affected only the budget, producers having fortunately been compensated by the higher quotations for sugar, which have averaged as much as 55 francs.

The import trade, which shares the vissicitudes of agriculture, and which had fallen so low during the sugar crisis, has steadily advanced to its normal position, and has maintained it in 1889.

In the export figures, the sugar products, molasses and tafia, show remarkable progress. Holders of the first of these products have got back, since the sanitary regulations were withdrawn, their customers in Martinique. As regards tafia, the calculation of 3,900,000 litres (858,000 galls.) is likely to be realised, the continued neglect of raw sugar and the conversion into alcohol of the syrup which was used in its manufacture providing more and more material for the distilleries.

The crop of 1889-90, in spite of the torrents of rain in the winter season, perhaps even thanks to those rains, presents a favourable prospect. According to moderate calculations it will exceed 100,000 barrels; as a matter of prudence the administration propose to adopt this figure in its calculations.

Quotations are declining; this movement, which is probably the consequence of the invasion of the market by beet sugar, hardly affects for the moment our colonial interests, and we may hope that prices will recover by the time for our crop, when cane sugar alone is coming into the European market. At the same time the allowance in duty (*détaxe*) covers to a great extent the expenses of every kind which rest upon our sugars on their arrival at the ports.

THE SUGAR INDUSTRY IN THE PHILIPPINE ISLANDS.

(United States Consular Report.)

As sugar ranks next to hemp among the products of the Philippines, and as its preparation for market is much more difficult and complicated than that of the latter, a description of the various methods and processes in vogue here will probably be of interest to the agriculturist as well as to the sugar importer and refiner. I am indebted for the following facts upon this subject to Mr. Frederico H. Sawyer, member of the British Institute of Civil Engineers, who has lived in the Philippines for many years, travelling extensively throughout the archipelago, making extensive notes of the sugar and other interests. He says that owing to its geographical situation, its beneficent climate, its vast area of fertile land, its facilities for inland navigation, its freedom from political excitement and disturbances, and above all, to its millions of natives fit for the rough labours of agriculture, this country is better suited than any other in the world to the cultivation of the sugar cane on a large scale. As the cultivation of the cane and the manufacture of sugar require a larger outlay in labour in proportion to the value of the product than any other staple, the presence of an indigenous population that occupies itself in this industry is of the first importance. In Cuba, Jamaica, Demerara, Brazil, Peru, Mauritius, Australia, Natal and other countries producing sugar, the cultivation depends almost entirely on the importation of coolies, which not only obliges the planter to incur heavy expense, but also involves many abuses and annoyances.

EXPORTS.

The exportation of sugar from the Philippines has reached one-third of the amount exported from Cuba, and the present condition of the industry seems to justify the expectation that within twenty years these islands will rank with that rich country in the production of sugar.

The following table will show the exportation of sugar from the Phillippines during the past twenty-eight years:—

Year.	Tons.	Year.	Tons.
1861	59,491	1865	61,797
1862	90,458	1866	61,422
1863	84,009	1867	72,306
1864	71,440	1868	82,970

Year.	Tons.	Year.	Tons.
1869	77,075	1879	149,679
1870	87,599	1880	203,163
1871	97,960	1881	235,380
1872	106,989	1882	171,636
1873	100,057	1883	238,242
1874	116,324	1884	137,675
1875	141,342	1885	226,983
1876	146,481	1886	158,095
1877	137,612	1887	200,646
1878	132,318	1888	207,544

But improvement in quality, Mr. Sawyer says, has not kept pace with the increase in quantity, and the condition of the industry in these islands has reduced the price of the sugar. For example, the price of Manila brown sugar in the Liverpool market early in January, 1880, was 18s. 9d.; in the latter part of the same months, it was 15s., at which it remained until January, 1882, when it fell to 14s. 9d.; in January, 1883, it was 11s. 9d.; January, 1884, 12s. 6d.; January, 1885, 8s. 9d., and there has been comparatively little variation in the price since.

In no sugar colony governed by Europeans is the mode of manufacture usually practised so primitive, expensive and irrational. This is the more surprising when the fact is considered that in the Spanish Antilles the making of sugar has been brought to a high degree of perfection, notwithstanding the difficulty the planters have in finding labourers. This is explained by the fact that in the Philippines, the planter has been compelled to throw himself into the hands of the natives, who rarely feel the necessity of work, and are content to move along as they have been moving for years, and by the other fact that the sugar lands have been in the hands of the natives, who have neither the means nor the knowledge necessary in order to undertake the manufacture of sugar according to modern methods. The sugar exported from Manila is almost entirely produced on the Island of Luzon, only a comparatively small portion of it, of a superior class, being received from Iloilo, for shipment by steamer to Spain. This probably does not amount to more than 1,400 tons per annum.

METHODS OF CULTIVATION AND MANUFACTURE.

The sugar districts of Luzon, beginning at the north, are Pangasinan, Tarlac, Nueva Excija, Pampanga, Bulacan, Bataan, Laguna

and Batangas. In the district of Morong is the plantation of Jala Jala, which promises to become very productive, and in the province of South Camarines, the Cansip plantation is famous as the first in the archipelago to employ the vacuum pan in sugar making.

In Pangasinan there are a few steam mills and quite a large number of iron ones run by animal power. The production is boiled down and the sugar is sent in "pilons," or cone shaped earthen moulds to Manila. The process of manufacture is of the most primitive description.

In Nueva Excija and Tarlac there are some plantations belonging to Spaniards that have good steam mills for the extraction of the cane juice, but they are not far in advance of the natives in the manufacture of sugar.

In Cabanatuan, however, there are sugar works lately erected with improved machinery.

In Pampagna, Bulacan, and Laguna the cane is generally planted on a smaller scale, but on numerous plantations, which are principally in the hands of natives and mestizos. It is possible that in these three provinces there are more than three hundred steam mills of from three to ten-horse power, and a few iron mills, the old stone and wood sugar mills having almost entirely disappeared. In these provinces the sugar, after having been brought to the proper density, is put into pilons, which are placed over pots or "ollas," and the sugar becomes purged of a portion of the molasses through a hole in the bottom of the pilon in a slow and very imperfect manner. The manufacture conducted in this manner, while giving a somewhat better quality of sugar than the system followed in other portions of the island, known as the "Taal system," is attended by several disadvantages, such as the cost of the moulds, their fragility and inconvenient form for transportation, the necessity of having large sheds or warehouses to contain them while purging, as they can only be conveniently arranged in a single tier; the great length of time required to effect the purging (frequently more than six months), causing the loss of interest on the value of the sugar, although each mould or pilon, yields a pot of molasses which may be worth about half a dollar.

Nearly all the planters use these molasses to mix with the sugar from the following crop, taking the greatest pains to incorporate with the sugar the largest possible quantity of this substance, which

the sugar planters of every other country in the world endeavour by all means in their power to eliminate. However, they adhere tenaciously to the custom, and their motive will be apparent in what I shall write of co-operative farming further on.

The planters of these three provinces suffered heavy losses from the burning of their sugar store houses and contents, from inundations, and the destruction of the roofs by typhoons or from earthquakes. All these losses are, of course, direct results of the absurd custom of keeping the sugar for so many months instead of selling it as soon as made, and not less have been the losses on many occasions from holding the sugar on a falling market without the least idea of the state of commerce.

But the great trouble attendant upon the manufacture of sugar in pilons is that it requires a special preparation before it is ready for export. This is effected in the establishments called "farderias," or drying grounds, which are located at Manila and a small town about five miles southward called Malabon.

At these farderias the pilon is emptied and its contents, a cone of dirty brown sugar, about two feet high and perhaps fifteen inches in diameter at the base, is cut into pieces and classified according to its colour and quality. It is then broken up with mallets and placed on mats to dry in the drying grounds attached to the farderia warehouses, where it is exposed to the sun. When perfectly dry it is mixed in various proportions so as to obtain a shipment of uniform quality and colour, after which it is packed in bags for delivery to the exporters.

As the farderos, or owners of the farderias, are the sole purchasers of pilon sugar, and as there are but four of these establishments, it is reasonable to suppose that they are usually able to buy at a very low price, owing to the limited competition.

The dry sugar exported from Manila is prepared almost entirely from the pilon sugar produced in the province named, and nearly all of it is shipped to the United States and England.

The wet sugar exported from Manila is produced almost entirely in the province of Batangas. The large town of Taal is the port of the sugar producing district of the same name. The inhabitants adhere strictly to old customs in sugar making, and are not only indifferent, but quite hostile to improvement.

In the Taal district there are several steam mills and a few hand

mills of English manufacture, but the old sugar mills of stone or wood, with vertical cylinders, such as were used in Europe in the thirteenth century and in the island of Madeira and Brazil in the fifteenth, are in general use. These rude machines, laboriously turned by buffaloes or oxen, by repeatedly breaking the cane, manage to extract about 40 per cent. of its weight in juice. This is boiled down in iron pans placed over a trench dug in the ground until the sugar and other solid matter forms a black, pasty mass of most repugnant aspect, which is the current sugar of Taal. This substance is taken from the pans and thrown into a corner of the shed in which the manufacturing process is carried on, a mud wall being built up in front of the heap as its size increases.

This wall is an essential part of the process, and when the filthy, black sugar is removed is, as far as possible, incorporated with it in order to increase the weight. This mixture is the Taal sugar of commerce. It is put into mat bags, about six of which make a load for a country cart, and long strings of these vehicles daily crawl down to the port, the molasses trickling from them along the road and mingling with the dust. The average loss in weight from the boiling house to the port, and from thence to Manila is estimated at about 2½ per cent.

The bags usually arrive at Manila in a most dilapidated condition, and are heaped up in immense warehouses, the stone floors of which slope toward pits or tanks provided to catch the molasses that is always dripping from the sugar.

Most of the Taal sugar goes to Europe, and before it can be shipped it is necessary to repack it into new bags. This operation is performed in the warehouses, where crowds of native men and women, the former almost naked, and all splashed from head to foot with molasses, are employed, the men emptying the old bags and filling the new ones, and the women scraping the old bags with knives to save the sugar sticking to them.

The old bags are sold to the distillers, who steep them to dissolve the sugar remaining, and use the liquor for setting up their vats.

The cost of discharging the sugar from the coasting vessels and of repacking it for export is about 17½ cents per picul, exclusive of the loss in weight.

Notwithstanding the precaution taken at Manila of repacking the Taal sugar, it is not uncommon to find upon the arrival of the vessel

at Liverpool that it is impossible to distinguish the different bags, as they are torn to pieces, and the fragments and the sugar have conglomerated into a solid mass, which must be excavated with pickaxe and shovel; and should the cargo belong to more than one consignee, the distribution must be made in proportion to the total weight shipped, as all marks have disappeared. The loss in weight during the voyage to Europe by sailing vessel is frequently from 10 to 12½ per cent.

The backwardness of the Taal district is the more noticeable since in Balayan, Tananan, and Batangas, all close to Taal, has been made for a number of years a sugar called "Improved Taal," which is sold at a price considerably in advance of that received for the sugar of the former district. In Balayan there are two factories using vacuum pans and centrifugals and turning out excellent sugar, while there are numerous steam mills in the other districts. Thus the Taal people are not without practical evidence of the advantages of improved machinery, but it seems to make little or no impression upon them.

In the province of Iloilo and the Ysla de Negros the conditions of the sugar interest vary considerably from those which prevail on the Island of Luzon. The cultivation of the cane is much more recent, and the development of the industry is due, in great part, to the active efforts of the late Don Nicholas Loney, to whom the planters desired to erect a monument, but the project was never carried out.

A large number of the regular plantations belong to Spaniards or Spanish mestizos, and the system of partnership just described does not prevail there, the work of the plantations being done by hired labourers who are paid by the day or month. While this system may increase the profits, it also affords the progressive planter opportunities to change established customs, if he desires to do so, and to introduce such improvements as he deems convenient, without having to consult with his tenant. On the other hand, he is frequently put to inconvenience by not being able to procure help when he needs it, as the natives, having no interest in the crop and so few wants and living very cheaply, work only when they feel like it, and exact much of their wages in advance. Again, there have been instances when a gang of labourers have presented themselves to the planter offering to work for whatever he was willing to give, demanding a large portion of their wages in advance, and disappearing a few days afterwards, or taking advantage of some pretext

for refusing to work. In Visayas, therefore, the question of help is considered of the greatest importance to the planter, and were it not that the fraud and vagrancy of the tramp labourer are severely punished by the authorities it would hardly be possible to cultivate the cane there profitably.

But the system followed in Iloilo is far more profitable and satisfactory generally than that of manufacturing sugar in pilons, or by the barbarous system pursued by the people of Taal. It does not require more machinery or apparatus than the others, but it is characterised by greater care, cleanliness, and accuracy in the process of manufacture. The juice is boiled until it arrives at a certain density, only to be judged by an experienced boiler, and it is then emptied into wooden troughs or trays in thin layers and beaten until it assumes a yellow colour, and becomes an amorphous sugar, known as "Superior de Iloilo." It is put in bags for sale immediately, and is ready for exportation without any preparation. It does not drip molasses, and its loss in weight is insignificant. Besides, the planter obtains for his superior sugar a price equal to that obtained by the farderos for their best Manila sugars. It is divided into three classes, and a cargo should consist of one-eighth of No. 1, two-eighths of No. 2, and five-eighths of No. 3. Recently, owing probably to experience in the process of manufacture, or to improvement in the method of cultivating the cane, the proportion of No. 1 has increased considerably, and a number of lots have been shipped composed entirely of this class.

In 1878 there was exported from Iloilo 45,472 tons of sugar; in 1886, 97,317; in 1887, 87,994; and in 1888, 87,325.

In the Island of Cebu there are several steam and 377 cattle mills, mostly of English make, the old wood and stone mills having almost entirely diaappeared. The lands are principally in the hands of natives, who have small plantations, and the cultivation of the cane has been on a limited scale. The system prevalent in Iloilo is followed, but the planters are less expert than those of the latter district, and their sugar is of an inferior quality.

There has been only a slight increase in the production of Cebu sugar since 1878. In that year 17,208 tons were exported; in 1886, 29,316 tons; in 1887, 19,882 tons; and in 1888, 18,697 tons.

Sugar Farming on Shares.

"Aparceria," or partnership, is the name given to the arrangement between the owner of the land and his tenant who undertakes

to cultivate the sugar cane on shares. There is probably not a single plantation on the island of Luzen where the labourer is hired by the day, week, or month. The conditions of the partnership vary according to the situation of the land to be tilled and established custom. If it is near a town, the labourer receives a smaller proportion of the produce than when it is near the jungle; for when it is in the latter situation, if he is not satisfied with the terms offered, he can clear a piece of land for himself and cultivate it on his own account.

Usually, in the province of Pampanga, the land owner provides the land, cleared and ready for the plough, the cane points for the first planting, sugar mill, boiling pans, and boiling house, money for the support of the labourer until the cane is harvested and for taking off the crop, and carts to carry the cane to mill. The tenant furnishes his labour and that of his family to plough, plant, and cultivate the cane and to fence the cane fields, the ploughs and other implements, and the cattle for service on the plantation, and to run the sugar house if it is made for cattle power.

Under these conditions the sugar is equally divided between the land owner and the tenant, but the increase in the yield of sugar resulting from the addition of the previous year's molasses is considered to belong solely to the land owner. This increase is at least one pilon in every eight, or about 12½ per cent., and is sometimes said to reach one in five, or about 20 per cent. of the crop. The facility with which a land owner is able to mystify his tenant under this custom is said to be one of the reasons why it is clung to so tenaciously. It is generally considered an absurd practice, and certainly depreciates the quality and reputation of the Pampanga sugars. The money advanced to the labourer for his support until the harvest is usually charged with interest at the rate of 20% per annum.

The cost of harvesting the crop for each lot of nine pilons in a cattle mill, and ten in a steam mill is:—

2 cutters, at 25 cents per day each..................	$0 50
1 cart driver, at 25 cents per day	25
2 mill men, at 25 cents per day each	50
1 cook and assistant	75
1 man to carry away the crushed cane	25
Total..	$2 25

Or, the cost may be estimated at 25 cents per pilon.

The land owner pays for the work and the tenant gives three meals

a day and cigars *ad libitum* to the workmen. The pilons cost 12½ cents each, and their expense is borne equally by land owner and tenant. In making up the account the land owner charges 6 per cent. interest per annum on the value of the land, the mill, sugar pans, etc., and the cook or boiler gets 25 cents. for each additional pilon of sugar that results from the mixture of the molasses of last year with the new crop. The owner usually borrows money from the owner of the farderia on account of his crop at a high rate of interest, and the tenant is always in debt to the land owner, thus forming a chain of debtors from the labourer to the fardero, and sometimes from these to the exporters.

Improved Methods of Manufacture.

Notwithstanding the fact that a general lack of energy and desire for improvement is apparent, there are planters who have shown a disposition to depart from the prevailing customs and to employ methods and ideas of the century in which we live. As early as 1879 Sor. Don José Feced y Temprado, in company with his brother Don Ramon, introduced the vacuum pan and other modern machinery and appliances on the plantation of the latter in South Camarines. This was the first time the vacuum pan was used in the Philippines for the manufacture of sugar directly from the cane. The product, it is said, could not have been improved, the first sugar selling in Manila at $8·50 per picul, and the second and third at proportionate prices. The works were constructed under the direction and plans of Mr. Sawyer, and were awarded a silver medal by the Sociedad Economica de Amigos del Pais.

The second vacuum pan was established on the plantation of the Rosario, belonging to Don Augustin Araulla, in the province of Batangas, and the third on a plantation near the chief town of the same province. These and vacuum pan sugar works established by Don Jose Rivera at Vigan, province of Ilocos, are the only ones at present in the archipelago. The total number of steam mills in use is 239, of cattle mills 5,920, and of water 35.

An analysis of the Rosario sugar shows:—

	Per cent.
Crystallizable sugar	99·30
Glucose	0·30
Mineral salts	0·18
Water	0·17
Organic matter	0·05
Total	100

Among all the analyses of coarse sugar made in 1881 by Wigner and Harland for the exhibition of alimentary substances in the Museum of Bethnal Green, London, the highest was the white sugar of Java, which was:—

	Per cent.
Crystallizable sugar	99·20
Glucose	0·20
Mineral salt	0·20
Water..	0·40
Total	100

The Batangas sugar also received a bronze medal at the Colonial Exposition at Amsterdam.

But probably the most formidable difficulty that presents itself to the project of manufacturing sugar of a high class extensively is the almost absolute want of capital, as in the entire archipelago there are not more than two or three planters with funds sufficient to afford even small sugar works. It is difficult to obtain loans even at ruinous rates of interest, and it is said that reform and improvement in this direction are opposed by the farderos and money lenders, who fear that their business might be ruined thereby. The first necessity, therefore, for the masses of sugar makers is cheap machinery, from which everything has been eliminated that is not absolutely necessary for the manufacture of sugar of the class desired.

It has been shown that the sugar juices are able to support the heat necessary to produce evaporation in the open air without alteration until it arrives at the density of 27½° Baumé, or 50° Balling, or until it has equal quantities of sugar and water. Past this point is where colouration commences, and the crystallizable sugar is gradually transformed into glucose or uncrystallizable sugar, and if the action of the heat is prolonged, caramel forms. For this reason, and in view of the necessity of economy in the cost, it has been considered advisable not to make the reforms all at once, but to begin where the greater evils exists. For example, the juice might be converted into syrup at 25° Baumé, and passed into waiting tanks to be concentrated in vacuo, doing without defecators, settling tanks, filters, evaporators, and the other usual apparatus, employing afterward the two indispensable—the vacuum pan and centrifugals.

In order to appreciate fully the merits of this system, it is necessary to compare the weight of the centrifugal sugar that it produces with

the weight of the wet sugar made after the Taal system. As nothing has been changed in the manufacture until the juice is converted into syrup at 25° Baumé, it is evident that only from this point forward could any loss occur. Experience show that from a "masse cuite" of, say, 6,000 piculs there may be produced 3,375 piculs of first sugar, leaving 2,625 piculs of molasses, with 56 per cent. of sugar, which the second time will give 750 piculs, and third time 375 piculs, leaving yet 1,500 piculs of molasses. The result would be as follows:—

3,375 piculs of No. 1 sugar, at $8	$27,000
750 piculs of No. 2 sugar, at $6	4,500
375 piculs of No. 3 sugar, at $5	1,875
1,500 piculs of molasses, at $1	1,500
Total	$34,875

The expense may be estimated as follows:—

Interest on $12,000, the cost of machinery, at 10%..	$1,200
Deterioration of property, 10%	1,200
Salary of engineer and cook	300
Fuel	200
Ten extra labourers for 100 days	250
Materials for the machinery	150
Unforeseen expenses	500
Total	$3,800
Produced by the vacuum pan system	34,875
Produced by the Taal system, 6,000 piculs, Taal current, at $2·50	15,000
Difference	$19,875

That there will be a vast improvement in the methods of sugar making in the Philippines within the next few years there can be no doubt. The native does not take readily to improvements, but when he stands by the side of his imperfect old wood or stone sugar mill, that needs a number of buffaloes to run it, and sees a little steam machine grind out thirty pilons at a cost of 75 cents or $1 worth of fuel per day, he can no longer doubt the utility of the latter, particularly when the price of buffaloes is increasing from year to year, owing to the ravages of the cattle plague in some of the provinces.

The natural market for the high sugars would be Spain, but export dues, high freights, and other expenses prevent much of it from going

there. I was shown two bills of lading recently for the same amount of sugar, one lot of which went to Barcelona by a steamer granted a subsidy and special privileges by the Spanish Government, while the other lot went to Liverpool, 1,000 miles further, on the English steamer, yet the freight on the first lot was \$15 a ton, and on the second less than \$8·25. "The mother country," as Spain is called here, evidently does not enjoy special favours in the way of freight rates.

DIFFUSION AND MACERATION IN THE STATES.

No. 1.

Report of a visit of the Editor of the *Sugar Bowl* to the Lagonda and Glenwild Estates.

At Lagonda, Mr. Lewis S. Clark's beautifully located plantation, we found the sugar house yard full of cane, with considerable standing, still green in appearance, with leaves partly singed by previous frosts.

First visiting the cane carrier, with its usual quota of hands, we followed the cane up to the Ross Cutter, a 48-inch level-feed, where two men were stationed to regulate the feed. It was so readily taking the cane and so smoothly making square cuts an inch and a half long, that the looker-on could not fail to be impressed that it could as easily cut 500 or more tons per day as it now does 200 tons. One man was at work grinding knives, and he also supervised the working of the machine. It had worked perfectly from the first. After leaving the cutter the pieces of cane were next passed into the Swenson Macerator, where two men stood, but their presence seemed to us unnecessary. The straight knives, firmly imbedded in a revolving cylinder, cut the pieces into shreds as fine as the best bagasse. This mass seemed to re-absorb the juice, as there was no apparent waste. The drags, placed on a wide revolving belt or carrier, conveyed the macerated cane up to the receiving shute, through which the chips are fed to the diffusion cells. These carriers seem to be the weak point about this process, as they sometimes break, stopping the whole process, but in another year that trouble will be overcome.

The diffusion battery, made by Messrs. Edwards and Haubtman, comprises 12 cells in two lines of six each. Cell capacity, about 2¼ tons of chips each. The circulation of water is from the bottom upward, the pressure being 30lbs. per square inch. This seemed to

be unequal to the requirements of the case, as at times there had been difficulties and some stoppage of circulation. Juice extraction appears almost perfect, as the intelligent young agricultural department chemist, Mr. K. P. McElroy, said his last observation showed but 56-100ths of sugar left in the chips. One cell is discharged every 15 minutes. Messrs. J. L. Bozarth and G. W. Kerr are in charge of the diffusion battery, assisted by four men. Liming in the cells is practiced at Lagonda, about 7lbs. per cell, thrown in with the chips. About 18lbs. more lime is put in the clarifiers. This we learned from Mr. Drauzin Folse, in charge of clarifiers and evaporators. The house works seven clarifiers. The discharged chips fall into a hopper below, where several men are placed to shovel them into a carrier beneath, which conveys them up to the first three of the five roller mill. As the mill was geared too slow to receive all the chips, about one-half are made to pass to the right, down a bagasse shute, whence they are carted off, while the balance passes on through the three rolls, the supplemental two rollers being opened so that they give no pressure, and treated thus the chips run readily, without the aid of other fuel, after the fire is once started. Next season, by simply gearing his mills so as to run faster, Mr. Clark expects to be able to burn all his diffusion chips. The Lillie Evaporators, worked as double effect, are doing good work, being in charge of Messrs. Wilfred and Lee Bozarth, brothers of the diffusion-cell man, all from Cedar Falls, Iowa. We found two other men working on the clarifiers and one on the evaporator. The chemical work, which is so important and necessary in all well regulated sugar houses, being in charge of a government official, can be relied upon. Mr. McElroy reported that the cane contains from 16·5 to 18 per cent. Brix; sucrose, 14·5; the extraction being 92 per cent. He found no special inversion, and believed that house secured clarification equal to any in the State.

The Sugar Yield.

As the chemist finds a juice extraction of 92 per cent., Mr. Clark must err when he estimates the sugar yield at 180lbs. per ton of cane. Mr. F. J. De Gravelles, the intelligent young sugar maker, (there for three years,) who was reared and instructed by his uncle, Mr. L. A. Roussel, the sugar expert, informed us that they were making an average of 40,000lbs. per diem, and at 200 tons per day, that would be just 200lbs. per ton of cane.

The evaporating plant, aside from the Lillie double effect, comprises two 8 feet vacuum pans—one low pressure, made by Messrs. Edwards

& Haubtman (worked by about 8 to 8½lbs. steam), and one a high pressure pan, made by Messrs. R. Deeley & Co., which requires from 65 to 80lbs. steam. The syrup is drawn from the settling tanks, and not worked immediately, as in some houses. The propelling power is ample for the entire plant. Mr. Edward Dunn, the New Orleans engineer in charge, informed us that in addition to the regular powerful engines and adjuncts, they had this season put up a new general service 50-horse power engine, from the American Manufacturing Co., to run the cutters, macerator, drags, &c.; a new Ludlow & Dunn pump from Cincinnati; an electric light plant, 250 lights, with an Edison dynamo, run by a Thompson & Houston engine, from New York, and that all the machinery worked as well as could be expected, with the changes made, excepting the defective circulation in the diffusion battery; but while we were there the water pump for the double effect gave out, and had to be repaired. Mr. J. Schwartz, engineer, representating Messrs. Edwards & Haubtman, was on hand to render needed assistance.

Lagonda will probably finish with their crop this week, including considerable bought cane, but we did not learn the probable output of the house. Mr. Clark informed us that his own was a short crop, owing to the bad season. However, so well pleased with diffusion is he, that he said he would as soon think of drowning himself in the bayou as of returning to the old milling process.

Glenwild, where Capt. John N. Pharr this year expended over $100,000 in an entirely new sugar house and diffusion plant, was next visited by us. Cane was being rapidly unloaded from the plantation railroad cars, directly on the carrier. He has four miles of stationary and one and a quarter mile portable railway. This gives him two portable switches to extend into his cane cuts. He hauls three cars of one ton cane each, per mule employed. However, with good roads, and haul of less than one mile, thinks cane carts the cheapest. Another Ross cutter, 48-inch, was there found actively and successfully at work, receiving the cane by *incline* feed (not so good as the level-feed), yet one man straightened the cane as it fell into the cutter. The cut was *shorter* than at Lagonda—say about three-fourths of an inch cut. A three feet macerator, same as at Lagonda, was also working well, attended by but one man, with one boy to remove trash. The cause of the delay and trouble at Glenwild Capt. Pharr described as follows:—" We have to run six carriers instead of two as before, and to work three machines instead of a mill as

formerly, and we all commenced as a lot of greenies to run machinery we knew nothing about, and had to learn how. When one of the six carriers got out of order (as they did often, because too weak), everything else had to stop. However, the machinery all worked pretty well otherwise, and now we are running along smoothly," The Whitney diffusion battery, made by the Whitney Iron Works Co., of New Orleans, comprises 16 cells in two lines of 8 each, with 176 cubic feet, or capacity for 4,870lbs. of chips per cell. The circulation at first was defective, because the chips were cut too fine, but now the battery works well. Mr. Paul Landgrebe, in charge of the battery, informed us that he had four men and one boy to assist him, and they discharged a cell about every ten minutes. The chips are fed to the cells differently from Mr. Clark's, by a top carrier passing the whole length of the battery, with cut-off and a stationery chute for each cell. When exhausted, they fall into a V shaped hopper similar to that at Lagonda, with cross beams to break the mass, so that men can shovel them down to the carrier, which passes beneath. At first an attempt was made to burn the chips, but they failed, because mill could not take all, so it was decided to cart them away. Capt. Pharr is sanguine that, had he time, he could so arrange his mill as to properly prepare them for his burner, and he will by another season.

Seventeen men are employed at various stations to handle the chips after they leave the diffusors—several under the cells, to shovel the chips on the carrier; others to remove them from the carrier before they bank up against the mill; others to cart them away, and one to spread the dumped mass. This, Capt. Pharr says, costs him $33 thrown away daily. All this has not damped his ardour for diffusion. He says he knows it will get *all* the sugar from the cane, and he will not be satisfied with less.

The Government chemist, Mr. John Fuelling, now assisted by Mr. Frank E. Coombs, of same department, late assistant at Calumet Station, informed us that the cane then being worked (from the windrow) averaged 9° Baumé, 16° Brix, with an average sucrose of 14%. He takes a sample of exhausted chips from each cell, mixes them, and gets about two average samples daily. Last week made 26 analyses of such chips, and there is an average loss of only about one-half one per cent. sucrose. Mr. Fuelling says he thinks they are getting about 200lbs. sugar per ton off cane, although Capt. Pharr, like Mr. Clark, puts it at about 180lbs. Average number of cells diffused daily, 107.

SUGAR MAKING DEPARTMENT.

Visiting the two large vacuum pans (8 feet diameter each), one Edwards & Haubtman's and the other R. Deeley & Co.'s, same as at Lagonda, we found the sugar maker and general superintendent, Mr. Albert Roussel, assisted by his brother Numa, sons of Mr. L. A. Roussel, and promising to fully maintain his reputation as a superior sugar maker and expert.

The sulphur machine is of Mr. Roussel's own design, with buckets to lift the juice up slowly and pour it down in a spray. They work on a five-feet wheel. Diffusion juice is treated precisely like mill juice, after being limed in the cells. At Glenwild it is passed from the sulphur machine to the clarifiers, seven in number, the old evaporators being used as clarifiers; next to the Lillie triple effect, which works well, and after being cooled to about 26° is settled in tanks and then pumped to the vacuum pan.

The cane crop at Glenwild and Fairview was among the best in the Attakapas. From 600 acres of cane Capt. Pharr expects to get 1,500,000 lbs. of sugar. This good crop is doubtless partly attributable to a more favourable season than some had, partly to tile drains, and to good management. Mr. Zach Cook is overseer on Glenwild, and D. Smith at Fairview. The best cane on Glenwild gave 20 and 21 tons per acre; 100 acres plant cane gave average of 21 tons. At Fairview some stubble gave but 10 tons, others 17 tons per acre. Frost hurt the back cuts so they had to be windrowed, while the front still had green cane standing. They have about two more weeks' work yet to finish the cane.

TOTAL TONNAGE OF CANE.

Up to the 20th inst., Capt. Pharr had passed 6,800 tons of cane, working about 200 tons daily, and he estimates that he had about 2,000 tons more to work. Of cane consumed 914 tons had to be sent to the Boy Blue mill of Pharr & Clark. Up to same date the evaporators at Glenwild had made 1,046,000 lbs. of sugar, including that from Glenwild cane ground at Boy Blue. We believe the above also includes 222 tons of cane bought from Bradley Bros. He informed us that his average first sugars from diffused cane was 128 lbs., while his total at Boy Blue by the mill was 140 lbs. Syrup from Boy Blue was boated down to Glenwild.

COST PER GALLON OF SYRUP.

Capt. Pharr says that, by comparison, he finds that a gallon of open kettle syrup costs him less than a gallon of diffusion syrup, but added that *increased* yield by diffusion more than made up the difference.

No. 2.

DIFFUSION AT DES LIGNES PLANTATION.

Increase of Nearly 50 per cent. over Double Milling.

Report of the Editor of the New Orleans' *City Item.*

We now present statistics from Messrs. Shattuck & Hoffman's Des Lignes plantation, which got through the crop about two weeks ago.

The result is an increase of nearly 50 per cent. in the yield of sugar per ton over the mill work last year, and this is notwithstanding the fact that the cane this year is lower in sucrose and higher in glucose than it was last season. The tonnage of cane just harvested was 6,868 tons, which yielded 1,368,005 lbs. of sugar. The double mill produced last year from this amount of cane only 997,180 lbs. of sugar, or 135lbs. to the ton. The difference, 440,825lbs. is quite a crop in itself.

In a critical analysis it is well to compare diffusion with what the best mills can do, but it is interesting and instructive to mark the actual gain on plantations that have adopted diffusion.

So much has been said of the possibilities of diffusion that unless the figures run well up into the hundreds, expressions of disappointment are heard. But it should be remembered that no process will extract more sugar than there is in the cane, and none that we know of will get all of it. The sucrose in the Louisiana crop has averaged this year but little over 200 pounds to the ton, and any work that approximated 200 pounds secured nearly all that was to be had.

A few weeks ago we gave a full description of the apparatus and methods at "Des Lignes," and it is our purpose in this article to deal with results rather than to repeat what was so recently said.

Harvest was completed in four runs. In the first two runs there was a good deal of loss in the mishaps and delays attendant upon getting new machinery and a new process to working smoothly. There was also some difficulty in getting down to a good extraction, and when this was obtained in the last run the yield was lowered by inversion, which had taken place in cane that had been lying on the yard. One of the troubles was a stoppage caused by leaky heaters. To tighten the pipes it was necessary to send to Wilmington, Delaware, for a pipe expander, although only thirty minutes was required to do the work after the proper implement had been obtained. It was during

this delay of six days that the cane was damaged, the glucose rising as high as 2 per cent.

For the following data of the four runs we are indebted to Dr. C. A. Crampton, the Government chemist in charge of the Des Lignes factory.

NORMAL JUICE.

1st run—Sucrose	12·77	Glucose	1·36
2nd ,,	13·41	,,	1·21
3rd ,,	14·39	,,	1·13
4th ,,	14·1	,,	1·58

SUCROSE IN CHIPS.

1st run	·74
2nd ,,	·57
3rd ,,	·59
4th ,,	·37
Average	·57

YIELD OF SUGAR PER TON OF CANE.

1st run	169 lbs.
2nd ,,	179·1
3rd ,,	204·7
4th ,,	212·3

In the last run the dilution was 33 per cent. although it had been higher in previous work.

Every run exceeded the available sugar calculated according to the ordinary formula of sucrose less one and a half times the glucose.

Sugar was boiled into first, seconds and thirds, except on the fourth run, when no thirds were made.

In giving the figures of the fuel consumption it is fair to say that experimental work and great dilution at the beginning of harvest and delays during the season should be taken into consideration.

The coal consumed per 1000lbs. of sugar was for the crop of 1888, 946lbs. and for 1889, 1597lbs. In the fourth run it was 1,000lbs. Bagasse was utilised as fuel in 1888, and the chips in 1889.

The mill took readily all the chips that were fed to it and no difficulty was experienced in burning them without the addition of other fuel. The biggest run for twenty-four hours was 317 tons of cane, although 200 tons was worked up in twelve hours. The fact that there was no trouble in burning the chips should dispel the popular idea that only a limited amount of chips can be utilized as fuel.

Very careful experiments were made at Des Lignes by Mr. Wibray J. Thompson, to determine the value of chips as fuel. He measured the water that went into the bagasse boilers and took frequent observations by pyrometer of the waste gases in the stack. His report on the subject will be of great interest. He estimated that by utilising the chips as fuel Des Lignes, saved on an average $50 worth of coal a day.

Mr. C. P. Binnings, the manager of the plantation, remarked that he had had very conclusive and practical evidence of the value of chips as fuel. On one occasion when both the vacuum pans were in operation, 80lbs. of steam was on the boilers, he noticed that steam fell to 60lbs. in a remarkably short space of time, and on inquiring the cause found that the carrier had broken and that the chips were not going into the furnace. He stopped the pans until the carrier was fixed, when steam at once rose to the required pressure.

Des Lignes is entitled to credit for surpassing other diffusion houses in the extraction the past season, and it has pre-eminence in having decisively and satisfactorily solved the question of utilising the chips as fuel.

THE PREPARATION OF SUGAR CANE FOR THE MILL EXTRACTION OF ITS JUICE.

From the *Louisiana Planter*.

There can, of course, now seem to be no reasonable doubt but that diffusion will, in time, become the chief means of juice extraction from tropical canes, as it is now with beets and sorghum. Yet there are so many good cane mills now at work, we can hardly expect them to be thrown out of use, until the margin for sugar manufacture is so reduced as to render their discontinuance imperative.

This necessarily leads to the enquiry as to how our cane mills can be made more effective, and the experience of this season seems to have shown more conclusively than ever before, that this can be done by any process that will shred or cut up the cane. The Newell shredder has been in use a number of years, and wherever used has given good results, so far as we have learned. The Ross cutter and comminutor has been well tested in some of our large sugar houses this season and has given excellent results.

There can seem to be no reasonable doubt but that canes that are

torn to shreds or cut to pieces and comminuted, are in a better shape to part with their juice, than if they went into the mill as whole canes. Men may argue as they may that the canes must get crushed, and well crushed if they go through the mill, but common experience shows that where a moderately heavy feed is carried, the mill grinding, say 200 tons per day, whole canes will pass through the first mill of a good double mill, although subjected to 125 tons pressure. These canes will have a large part of their juice extracted, but their emerging from the mill of full length shows that part of the energy of the mill has been expended in simply compressing or flattening the canes, and that by the time this was done, the canes were through the mill with the extraction but imperfectly done, and the power of the first mill that should have been utilized in extraction having been expended in the preparatory work, the use of the first mill for actual extraction is lost.

This fact being now generally recognised, there has been some disposition to erect auxiliary mills to thus crush or prepare the canes, so that the standard double mill shall have its full power exerted in actual extraction.

This would seem a wise move, but suggests the inquiry as to whether or not this work of preparation cannot be better done and more cheaply done by some other means than by crushing in a mill.

If sugar canes need to be torn into pieces or cut into pieces, to so affect them that they shall surrender their juices more readily, it would seem to be a plain mechanical proposition that this can be better done and more cheaply done by some tearing, shredding, or cutting device, than by any crushing device. The boy splits his kindling wood into pieces with an axe. He does not crush it into pieces with a sledge.

The shredding, cutting, and comminuting machines are what now do this work the most effectively and the most cheaply, both in cost of mechanism and in cost of power expended.

The excellent results obtained in all the houses where these devices are employed should lead to their investigation now while the experience is recent and correct conclusions can be obtained.

Our planting community can only hope to meet the difficulties that environ them by adopting the best devices obtainable for their sugar manufacture, and there is not much hope of any permanent success if any considerable amount of sugar be left in the bagasse, and

adequate preparation of the cane before the mill pressure is applied is now proved to be the easiest way to increase the extraction and to thus reduce the sugar left in the bagasse.

There is another very serious advantage of those shredding, cutting, and comminuting devices, that demands more consideration than has yet been allotted it. The saturation of the bagasse between the mills that is now in such general favour, is rendered doubly effective if the cane comes from the first mill a pulpy mass that will absorb all the water thrown upon it. If the cane emerges from the first mill in large, coarse pieces, it cannot absorb the water, and the saturation between the mills loses much of its effectiveness, while if it comes from the first mill in a pulpy mass, it will absorb water up to 25 or 30 per cent. dilution of the normal juice, without any water passing through unabsorbed.

CANE CUTTING.

In our issue of December last we inserted, at page 626, a paragraph on Cane Cutting, taken from the *Louisiana Planter*. The following further communication to the same journal deals with the same subject:—

In your issue of the 9th ult. there is a letter on the above subject which deserves some consideration. In my last letter to you I remarked that bad sugar is generally caused by bad boiling, and hence the boiler must not be overlooked. While this is practically true, bad yielding sugar, if not very bad sugar, may be the result of *bad cutting*.

Doubtless many of your readers more familiar with your sugar industry than I am may think my remarks quite foreign to the subject, but still they may have their value.

If a cane be cut too high the result is a poor juice, as compared with the juice from properly cut canes. The high cut canes require more fuel to concentrate the juice, and the tops often cannot make sugar at all, and this places the sugar boiler in a quandary about his yield, and the whole work of the house is delayed. So much for high cutting.

Now as to low cutting. The joints of cane become shorter the nearer they are to the ground. Canes with joints a foot long diminish these lengths of joints to one-fourth of an inch under the ground. In cutting canes the best way for the estate is to cut them below the

surface of the ground. By doing this you have every reason to hope for a good rattoon crop. On no account should the stumps be left to project above the surface, as such stumps will never produce good canes. If the stumps be left above ground they should be cut off level with the ground, and I should not pay for such work until I knew it was done.

In cutting cane, to do the work well, with, say, 100 cutters, I should say to divide them into four gangs of twenty-five each, with a boss for each gang. This will enable the overseer and bosses to supervise the work more thoroughly, and this work well done will insure a good crop.

WEST INDIAN OBSERVER.

NEW PROCESS FOR OBTAINING IN ONE OPERATION ALL THE EXTRACTABLE SUGAR.

From the *Neue Zeitschrift.*

The process in question was patented in Germany, in April last year, by Mr. Theodore Boegel, of Brieg.

The inventor proposes to obtain a masse cuite, which contains only a minimum of water, and hence will allow all the extracted sugar to be obtained at one run. He states that it is very difficult to eliminate, whether by evaporation or by drying, the water of the masse cuite as to obtain it in an almost perfectly dry state. He has, therefore, endeavoured to solve the problem in another way. The juice of the beet, or other sugar-yielding plants, or the solution of raw sugar, is evaporated in vacuo in the ordinary way, and then boiled to granulation. The syrup is next separated from the crystals by the usual operations. The run off syrup is then boiled rapidly in the evaporating apparatus, being brought quickly to a temperature of from 95°C. as minimum and 138° as maximum. In a receiver, furnished with a heater and a stirring apparatus, the evaporated syrup is heated and kept in constant motion, the sugar which has been previously separated, or a nearly equivalent quantity of raw sugar, being added little by little.

It is advisable to keep the temperature within the limits of 100° to 110°C., but this is not a *sine quâ non* of success. At these temperatures the syrup forms, with the re-melted raw sugar, a masse cuite containing very little water, but which is still fluid or semi-fluid,

although very dense. This masse cuite is afterwards run into crystallisers placed in an enclosed chamber and susceptible of being heated, where the whole is left to cool very slowly.

In this manner, if the process has been properly carried out, a crystallised, solid, and almost dry mass is obtained. This is then mechanically divided, and clarified by the usual means, or else washed. If the washing is effected by alcohol, almost the whole of the sugar is obtained in a pure state; the proportion of sugar passing into the alcohol used in washing is so very small that there is no need for any further extractive process to recover the little which it contains.

The process can be applied in another manner. To the masse cuite prepared in the ordinary way, which is heated and worked continually, raw sugar already crystallised is added until a masse cuite is produced, saturated to such a degree, that on cooling it forms a solid and dry mass. This is clarified and then washed, as in the preceding operation.

The inventor asserts that by this treatment he obtains, in the state of raw sugar, all the sugar contained in the various sacchariferous plants, and this in one run, that is to say, without having recourse to several successive crystallisations, which, following the ordinary methods, yield first, second, third, or even lower products.

CLAUS SPRECKEL'S NEW REFINERY.

This immense undertaking has now commenced operations, and as soon as it is in full work will be able to turn out 2,000,000 lbs. of sugar in twenty-four hours.

The following details will be interesting:—

The buildings now completed consist of the warehouse, 155 feet long by 60 feet wide, having an area of 18,000 feet; the finishing house, 83 by 75 feet, with an area of 12,720 feet; the char filtering houses, each 152 by 68 feet, with a total area of 41,344 feet; the pan house, 157 by 60 feet, with an area of 18,870 feet; the boiler house, 265 by 58 feet, with an area of 19,000 feet; the bay filter house, 166 by 60 feet, with an area of 9,960 feet; the machine shops, 200 by 75 feet, with an area of 1,000 feet; the barrel factory, 250 by 130 feet, with an area of 25,000 feet. Besides these there are the offices for the engineer, the superintendent and the staff of clerks; the laboratory of the chemist and his assistants, and the buildings for the electric

light plants and machinery. The actual cost of the buildings, machinery and site has not been definitely stated, but it is believed that it will amount to more than $3,000,000.

Running on to the refinery property are three distinct lines of railroads, forming direct communication with every section of the country. On the river are three wharves, each 80 feet wide and 600 feet long. Here a dozen of the largest-sized ships and steamers can load or discharge at the same time, there being ample depth of water at the lowest tide. The wharves are covered, forming immense warehouses where the raw sugar can be received and stored in bond or delivered without handling into the melting pans. A conveyer runs along the whole length of the dock, carrying sixty tons of sugar to the pans at a speed of eighteen feet per minute. The whole of the buildings are lighted by incandescent lights of the Westinghouse alternating system, supplied from a central station on the grounds. Automatic sprinklers for protection against fire are distributed throughout the buildings, and everything has been done to make the refinery the best equipped and most economically worked, as well as the largest in the world.

Mr. Spreckels a short time ago decided to duplicate the whole of the buildings described above and now in operation. This will give the refinery a capacity of 4,000,000 pounds or 2,000 tons of sugar every twenty-four hours. Work was commenced on the duplication of these buildings a month ago by the erection of a dividing fence, so that the new work now in progress will not interfere with that which is completed. This duplication of the plant will, it is expected, be completed before the end of next year.

BEET SUGAR IN CANADA.

A Letter to the Editor of the *Sugar Beet*.

Some years since you solicited of me information respecting the Farnham (P. Q.) beet sugar factory. Herewith this day I send a synopsis of my observations on Canadian sugar factories. Of the three beet sugar factories existing in the Province of Quebec only one worked this year. For various reasons the profits were not satisfactory. The success of this industry is possible, and the manufacture of sugar from beets will in time come to be considered the most remunerative of the country. Having had considerable experience in

beet sugar making, I am able to grasp exactly what has been done since 1881 in the three factories then started, and assert that the failures are due to two causes:—

First.—Bad management.

Second.—Want of working capital.

Last year I rented the Farnham factory in the name of a small number of French capitalists; fearing to risk their capital in a too restricted campaign they concluded not to work during 1889. The production of beets would not have been sufficient to meet the demands; the contracts with farmers had not been completed before the winter; the area possible to devote to beet-growing was too small for a reasonable crop. If I am able to again re-unite my friends, the French capitalists, before the fall ploughing, I intend to make arrangements for numerous contracts. It is without doubt demonstrated that it is not possible to raise beets delivered at factory for less than $5 a ton; and if granulated white sugar is sold for seven cents per pound the profits should be at least $5 per ton of beets worked. Each of the two factories, Berthier and Farnham, has a working capacity of at least 15,000 tons. When I see in the *Sugar Beet* that American capitalists are disposed at considerable money outlay to construct new factories, I am at a loss to understand why they do not give preference to the foregoing, now in waiting, located only a few hours from Boston and New York, in a country where numerous farmers have already had experience in beet raising, and are only too anxious to renew their efforts in this direction.

If these considerations attract the attention of your readers, I will willingly place myself at their disposal for further information. The situation, from a farming standpoint, is made manifest, when it is considered that many farmers are growing sugar beets for their cattle; and as each factory (Berthier and Farnham) has a complete laboratory attached, analyses may be made from samples taken from the field. The Berthier factory worked this year. From an agricultural standpoint the campaign has been a great success, beets were purchased at $4 a ton, and farmers were willing to contract for almost unlimited areas for next year. Unfortunately, however, only 30 tons of roots have been worked per diem, while the capacity is for 200 tons, and during the campaign of 1882 there was an average of 150 to 170 tons utilized per 24 hours.

A. MUSSY.

Berthierville, Canada.

SUGAR ANALYSES.

A paper read before the Académie des Sciences, 2nd December, 1889.

In a former paper we saw that weak acids do not modify the rotatory power of lævulose, whilst it is increased by strong acids in a degree which is always marked, but which varies with circumstances. This fact exercises a considerable influence on the accuracy of the different methods used in analysing sugars.

We will take first the classical method of Clerget, in which a mixture of saccharose and inverted sugar is examined by the polariscope and by inversion. From its very origin, Peligot and also Dubrunfaut objected to it that it *forced* the weight of the saccharose; prolonged practice has confirmed this judgment, without however indicating the cause of the error produced. This cause has now become manifest through our experiments, which have shown that there is a grave irregularity in the very principle of the method.

To simplify matters, we will suppose that in inversion no change takes place in the weight of the saccharose, and will take, as the rotating power of the inverted sugar, figures which have been established under this supposition. Further, we will give to the mixture of equal weights of glucose and lævulose, not changed by strong acids, the title of *normal inverted sugar;* this mixture, supposed to be of the same weight as the saccharose from which it proceeded, gives $a_D = 21°, 16$ to $15°$ for a solution of 20%.

The Clerget process may be explained as follows:—A being the deviation produced by 1 decimetre of the liquor in which are sought the weights of saccharose (x) and of the inverted sugar (y), *o* A' being the deviation caused by the same liquor inverted by a strong acid without altering the concentration,—$a_D = +67°, 31$ and $a_D = -24°, 31$ being the rotating powers of saccharose and of inverted sugar, two equations are established, giving x and y:—

$$\frac{67'31}{100}x - \frac{24'31}{100}y = A, \text{ and } \frac{24'31}{100}(x + y) = A'.$$

The results thus obtained are mostly inaccurate. Contrary to what is supposed by the first equation, the pre-existing inverted sugar is normal in sugar products, whether naturally or artificially produced, which have not been exposed to the action of strong acids, and its rotating power, which to begin with is about $a_D = 21°, 16$, increases considerably during inversion. Supposing that this power becomes in this manner $a_D = -24°, 31$, the calculation indicates a plus error in

the saccharose (an error in the proposition of $\frac{y}{x}$, that is to say), increasing with the weight of the pre-existing inverted sugar, viz., 1·33% with three parts of saccharose and one part of inverted sugar; 3·40% with equal parts; and 10·2% with one part to three parts.

As a matter of fact, these calculations exaggerate the error committed. We have seen that when normal saccharose or inverted sugar is treated with dilute strong acids, the product is always more strongly lævogyric in the first case than in the second; in other words, the lævulose is more modified, under the influence of the strong acid, at the very moment when it comes into existence during inversion, than when it has been formed beforehand in normal state. Thus, in using Clerget's method we have seen the rotating power of the normal inverted sugar pass from — 21°, 16 to — 22°, 88; the plus error in these circumstances reaches a further 1·80% on the weight of the saccharose in a mixture of equal parts, and 5·6% in a mixture of one part of saccharose with three parts of inverted sugar; in both cases the weight of the two sugars united is too low by 2·95%.

In dealing with a commercial crystallised sugar, containing only a small quantity of inverted sugar, the error is not great, and passes unperceived, and so the method has continued to be applied in such cases; what we have just stated explains its failure and its disuse when dealing with substances containing a large quantity of inverted sugar, such, for instance, as the juice of acid fruits.

When the substance analysed contains glucose and lævulose in unequal quantities, its three component parts are sometimes determined by means of a similar calculation, a third equation being established by ascertaining the quantity of sugars which reduce the cupro-potassic liquor. The same reserves are still applicable in this case.

The first means of remedying the defects pointed out which occurs to the mind is the replacing of the strong acids by weaker ones. We have in fact stated that acetic acid, for example, inverts saccharose without modifying the lævulose produced. It gives accurate results with sugars which are free from foreign substances; but on applying it to the same solutions to which various salts have been added, we have met with unexpected facts which are opposed to its general use.

Inversion by acetic acid being practised by some chemists, we shall indicate the value of the information which according to our experiments it affords.

1. The alkaline acetates, which do not interfere with the inversion of saccharose by strong acids used in excess, prevent inversion by acetic acid, even when it is employed in considerable excess. Where one molecule of acetate of soda is present, one molecule of saccharose is not completely inverted, even when kept at 100° for half-an-hour, by a weight of acetic acid attaining as much as 80 molecules, the inversion gives as far as 5·59% of the sugar with one molecule of acid; 46·5% with 20 molecules; 65·8% with 40 molecules; 80% with 80 molecules; concentration modifies only slightly the figures obtained. The sum of the observations made, whether with the polariscope or with reduction by copper, shows that we are not here dealing with a simple action of the salt on the optical properties of the product; the addition of the acetate to the liquor already inverted by acetic acid has only the very slightest influence on the deviation observed.

2. Citrates, formiates, lactates, and alkaline tartrates, acetates of zinc and lead, &c., behave in a similar manner. Acetate of lime is, as is well known, less active.

The monobasic salts of the strong acids ($H\,Cl$, $H\,Br$, $H\,I$, $AzHO_6$, $Cl\,HO_6$, &c.), do not prevent inversion by acetic acid. The bibasic neutral salts of the strong acids diminish it when their metal is monovalent (K, Na), but not when their metal is bivalent (Zn, Cd, Mg, Mn). The polybasic acid salts of the strong acids do not prevent inversion by acetic acid; some of them even effect it themselves (bisulphates, bioxalates).

Independently of any other disturbing cause which may co-exist, these facts are sufficient to explain the irregularities met with in applying acetic inversion to the analysis of products rich in salts of organic acids, such as molasses and certain vegetable syrups.

ON THE FACTORS WHICH GO TO FORM THE PRICES OF SUGAR.

In our January issue we gave on page 9 a translation of an interesting paper on the above subject, which appeared in the *Prager Zuckermarkt* of the preceding month. The following is a continuation of the subject:—

The second proposition with regard to the theory of the formation of prices was that the latter is more strongly affected by the beet

sugar than by the cane sugar production. This remark may appear superfluous to the superficial thinker, as it appears to him a matter of course that beet should influence the formation of prices more than colonial sugar. This supposition is a proof of superficiality in judgment, for which we are, however, not disposed to reproach anyone, because the matter is really of a somewhat difficult nature. The fact that the formation of sugar prices is more influenced by beet than by cane sugar is of a special importance not only as regards theory, but also in practice, as it most clearly proves that the general market is exposed, now and again, to influences which are one-sided, and consequently not justified by the actual state of things.

It is beyond question that the market for an article of universal production should, as a matter of fact, only be influenced by the circumstances of that universal production. This is the more applicable in the case of sugar, inasmuch as the two powerful rivals, beet and cane sugar, are about equal as regards quantity. We are, therefore, perfectly justified in expecting that the world's sugar market should be influenced in an equal degree by these two factors, that is to say, that to each of them neither more nor less influence should attach, as regards the formation of prices, than belongs to its importance as a whole when compared with the total production of the world. This is what should be; that this is not the case is proved, for example, by the movements of prices during the campaign 1888-89 to a frightful extent.

The deficiency in the colonial sugar production and in the stocks everywhere had been known for a long time, notwithstanding this prices of sugar showed no disposition to move until March, because the beet sugar production of the campaign was a large one! How was it with the total production and stocks of the world? This question remained unnoticed until matters had assumed a really unpleasant shape, so that even an English minister mentioned in a full House of Commons that the world's market was threatened with a veritable sugar famine.

The fact of beet sugar influencing the formation of prices more than cane sugar does not, then, appear self-evident in the sense that it must necessarily be the case, but is only a proof that even a market which is open to the world is exposed to influences which are one-sided and hence not justified by the nature of the case.

And we must here point out something further. In our last article

we stated plainly that, desirous as we were of dealing strictly objectively, and with a close regard to facts, we could not do otherwise than indicate consistently (not being led away by the superficial conceptions of the multitude) the unwarrantableness of the declines in prices during the four last campaigns. We considered ourselves justified in taking up the attitude by the fact that all these four campaigns were campaigns of under-production.

At present we only wish to complete our remarks by the statement that the facts themselves have justified our position in the very fullest manner. The great advance in prices of the past year was, at any rate partially, brought about in an artificial way, but it is abundantly evident that, without material bases, such an advance could not have been effected even with the most copious funds at command. The possibility of this advance must then have been due to the actual statistical position of affairs.

But the general statistical position of an article of universal consumption does not change all in a moment; a certain length of time, more or less, is required before matters become as desperate as they were in the spring of last year. As a matter of fact, the way for this state of things was already being prepared ever since 1885-86, and hence this great advance must be looked on as the result, as the final effect of the more favourable statistical position which the article has been steadily assuming during the four preceding campaigns.

As a second factor in our present consideration may be indicated the fact that if the statistical relations had steadily improved and become more firmly established by means of these four campaigns, the improvement and establishment of sugar prices ought to have gone hand in hand with them. In other words, it is again a very sad proof of the state of the great market of the world that the prices of sugar could possibly have been maintained at so low a level until *immediately before* the enormous advance. If things had taken their proper course, the prices of sugar ought for a long time before the advance to have commenced to rise, even though slowly, and this is again, undoubtedly, a further warrant for the position assumed by our journal, when we consistently indicated the decline in prices as being logically indefensible according to the nature of the position of the article, a position which was fully justified by the enormous advance which eventually took place.

THE CHAMBER OF COMMERCE OF REUNION ON THE *DETAXE.*

In a sitting held on the 24th September, at Saint Denis, the Chamber of Commerce of the Island of Réunion discussed the question of the allowance of duty on colonial sugars (entering France). The chamber has several times expressed the wish that the colony should not be compelled to send at considerable expense its sugar to the mother-country, in order to obtain the allowance (*déchet de fabrication*) which is granted under the present legislation, and that the Government would have this allowance fixed and granted at Réunion, in this manner, the sugar of Réunion would be able to take advantage of the neighbouring surrounding markets, such as India, Australia, and the French possessions in India and China, the advantages granted to the colonies would then be complete, and would be the same as those granted to the mother-country.

Correspondence.

BARBADOS SUGAR ESTATES.

TO THE EDITOR OF "THE SUGAR CANE."

Sir,—As I know it is your intention to transfer to the columns of your periodical the letter I wrote to the Editor of the *European Mail*, *re* the sugar question, I send you a few additional remarks, in order to emphasize it.

The Barbados Sugar Estates Company, when they bought the Oxford Estate in February, 1889, not only found a crop on it ready to be reaped, but also shooks and staves, woodhoops and lumber. These estate supplies are, as a rule, purchased in November and December. More than this, the receiver of the estate would probably have had these materials made into what are called gunned hogsheads, ready to be completed so soon as there was sugar to fill them.

Again, as receiver, any sums spent upon the upkeep of the estate would rank as a first lien upon it. He doubtless found the estate and its buildings in a very imperfect condition, owing to the straitened means of the owner, who had been forced to let it fall into Chancery. He would rightly see, for his own credit, and for the good of the creditors, that the estate was put into the best condition to secure a

favourable crop. I believe the crop reaped by the company was a highly favourable one in respect of quantity, and owing to the fear of a great deficiency in the sugar supply, it was sold on very favourable terms. Again, many of the planters when they plant their crops apply artificial fertilizing composts at the time of the planting. It is possible, therefore, that the company had this compost without paying for it. The crop for 1890 was also planted in November or December, 1888. The company, therefore, have for this year's crop saved the expense of planting it and tending it for some three months They will therefore reap this crop with advantage, but considering. the vicissitudes of the cane sugar industry, I think they would have acted more prudently had the company carried a larger sum than £50 to the reserve fund to meet contingencies.

In conclusion, I mention, to shew the great depreciation of property in Barbados, that the Frere Pilgrim Estate, that was sold not many years ago for £20,000, is now in Chancery. It has on it ready to be reaped an estimated crop of 213 hogsheads. It has been appraised at £11,450. This of course includes the value of the land, 226 acres, the buildings, the cattle, mules, carts, &c.

I am, yours, &c.,

W. H. JONES.

Hermont Road, Upper Norwood,
25th January, 1890.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. THOMPSON, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

20515. C. STEFFEN, London. *An improved process for obtaining the entire quantity of crystallisable sugar contained in sugar mass.* 20th December, 1889. (Complete specification.)

20530. R. TERVERT & G. REID, Glasgow. *Improvements in or connected with filter presses.* 21st December, 1889.

20548. J. R. WATSON, Glasgow. *An improved retort and filter stand.* 21st December, 1889.

20573. R. BERGREEN, London. *Improved knife for slicing sugar-beets, sugar canes, and the like.* 21st December, 1889.

20809. A. C. COLE, London. (Communicated by Alanson Townson, Brewer, United States.) *Improvements in presses.* 27th December, 1889.

ENGLISH.

ABRIDGMENTS.

9021. 1889. JAMES FOSTER, of Baltic Chambers, Sunderland, Derbyshire, Engineer. *Improvements in and relating to the drawing off and condensing of the vapour from sugar pans, and apparatus therefor.* May 30th, 1889. The vapours pass downwards into a cylindrical casing or "save all" where a portion condenses, and may be drawn off by means of a cock, a gauge glass serving to show when a considerable quantity has accumulated. The uncondensed vapour rises and overflows the edges of the casing, and passes down an annular space around it, and finally comes into intimate contact with an atomized jet of water thereby being completely condensed. If any vapour should by chance escape condensation, it may be treated in a similar apparatus in connection with the exit of the first one. A fan, pump, or other suitable source of power is used to create the necessary draught.

AMERICAN.

ABRIDGMENTS.

416319. W. BAUR and J. V. V. BOORAEM, of Brooklyn, N.Y. *Apparatus for packing cut sugar.* Dec. 3rd, 1889. Specially applicable for packing "tablet or domino sugar," such as produced by the cutting machine shown in U.S. patent No. 349027, or by means of a plate, such as shown in No. 349027. A packing case or box is made complete, with the exception of the top and one end, and is placed on a table, with the open end lying just on the edge thereof. A shallow tray containing a layer of cut sugar is placed in the box, and the tray is then withdrawn, leaving the layer of sugar evenly lining the bottom of the box. This operation is repeated until the box is filled with the superimposed layers. A gauze plate, clamped to the edge of the table, prevents the sugar already deposited in the box from being dragged out when the tray is withdrawn, and it may be raised after each layer is added. The box is completed by fastening on its top and then raising it and the plate into an upright position and nailing the end in place.

416455. T. GAUNT, of Brooklyn, N.Y. *Evaporating apparatus.*

Dec. 3rd, 1889. An apparatus for freeing the vapour from an evaporator from solid or liquid impurities. The vapour is caused to pass into the top of a vertical chamber, into which an exit pipe dips. The exit pipe is surrounded by a deep spiral vane or wings, and the vapour impinging on this is caused to travel in a spiral or circular manner, thus throwing off the suspended impurities by centrifugal force. The impurities collect on the sides of the chamber and trickle down, whence they may be removed by a pipe. If the vapour is to be used in heating a second evaporator, a great saving is effected by the purifying operation, as the formation of incrustations is prevented.

416456. T. Gaunt, of Brooklyn, N.Y. *Evaporating apparatus.* Dec. 3rd, 1889. This invention consists of a complete evaporating plant, and refers to details of construction and arrangement. It is applicable for multiple effect, and one of its chief characteristics is the fact that the thin solution is exposed to the greatest heat, while the thickened and partly evaporated syrup is treated by a gentler heat, thus avoiding the formation of caramel or invert sugar. A liquid seal is provided between each apparatus or separate evaporator.

416709. F. Bauder, of Paris, France. *Process of refining sugar.* Dec. 10th, 1889. The crystals of raw sugar are placed in an hermetically closed centrifugal machine surrounded by a steam jacket. Steam is introduced to the interior of the cage, which is then revolved for about ten minutes. This operation partly purifies the sugar and also serves to damp it. When the mass is properly heated and moistened, a current of electricity is passed through a pair of electrodes, which pierce the cover and dip into the mass. The continuous spark between the ends of the electrodes developes ozone, and the sugar is bleached thereby, the electric current being continued for about ten minutes. In practice the steam must be cut off at least ten minutes before interrupting the current and stopping the machine. When the draining is complete, the crystals are obtained in a refined state and are crushed and bolted, afterwards being clarified by means of an atomizer and moulded by pressure into any convenient shape, and finally dried by heat. The syrup drawn from the centrifugal may be incorporated with the crushed crystals and again refined as above or treated in any ordinary manner.

417799. A. Waldhaur, of Stuttgart, Würtemberg, Germany. *Centrifugal machine.* December 24th, 1889. These improvements appear to relate more particularly to centrifugal machines for use in dyeing or similar operations. The liquid which escapes through the

perforated sides of the basket, flies against a second casing surrounding and revolving with the same. The interior of the revolving casing is scored in a helical direction, or provided with helical ribs which when the machine is revolved cause the liquid to be gently directed downwards towards the exit. The basket lid (when used) is kept in place by means of eccentric fastenings which are tightened automatically by levers connected thereto, and carrying weights which are driven outwards by the centrifugal force produced in revolving the basket.

417848. G. E. WHEELER, of Chazy, New York. *Evaporator.* December 24th, 1889. The tray or pan is mounted directly above the fire. The sides of the fire-place are surrounded by an external casing, thereby forming air spaces and the space under the sloping position at the back end of the furnace is similarly utilized. The air heated in these spaces flows upwards and over the surface of the substance in the pan, and is then carried off by the smoke stack or by separate channels. The pan may have a non-conducting lid, such as is patented to the present inventor, No. 393196 (U.S.), suitable dampers are arranged composed of air inlets at various points.

418262. A. YOUNG, of Honolulu, Oahu, Hawaiian Islands. *Diffusion Apparatus.* December 31st, 1889. This apparatus is designed to obtain all the advantages of continuous automatic diffusion while obviating the inconveniences of the cell battery mode of working, a curved tube having its ends higher than its middle is permanently fixed in a suitable support such as masonry. The curve of this tube is preferably catenary. An endless chain composed of a series of perforated pistons or followers is caused to travel continuously or intermittently through this tube by means of a pair of chain or sprocket wheels placed one at each end. The bagasse or other matter to be treated is fed into the tube in such manner as to be carried through it by the followers. Water or other suitable liquid is fed into the other end of the tube and extracts the soluble matter, the enriched liquid leaving the tube at the end at which the bagasse enters, and which is slightly lower than the opposite end. The lower middle portion of the tube is preferably about 30 feet lower than its ends thus ensuring a good pressure of liquid to extract the soluble matter. Steam jackets may be used to ensure a convenient temperature. One stated advantage of this apparatus is the fact that atmospheric air is kept from the bagasse during its treatment.

GERMAN.

APPLICATIONS.

48075. PRAGER MASCHINENBAU-ACTIENGESELLSCHAFT PRAGUE, Bohemia. *Improvements in pocket filters.* (Buckelblechfilter). 15th December, 1887. This filter belongs to that class of filters in which a vessel contains a large number of very flat separate filter plates or pockets into which the liquid which is introduced into the vessel filters, leaving the sediment behind on the upper surface of the filters. The filter pockets of the improved filter are inserted into narrow openings made in a common discharge chamber, and are formed of bossed sheet metal over which a smooth filter bag is drawn. These sheet metal plates (*Buckelblechtafeln*) are preferable to the corrugated ones usually employed, in that their upper edge always remains smooth and thus a surface is preserved impermeable to liquid. A saving of metal is also effected by the use of this sheet metal. Instead of using single bags as in the ordinary method employed, for covering these plates, ten or more filter bags sewn or otherwise fastened together are drawn over these separate sheet metal plates, and only on their four outer edges rendered impermeable to the liquid. Suitable apparatus is provided for changing the filter bags when found necessary.

ABRIDGMENTS.

49214. EMIL HEFFTER, Breslau. *Improvements in the process patented under No. 39279 for clarifying saccharine juices, by the aid of tannic acid.* 15th September, 1888. In order to completely clarify the saccharine juice, it is advantageous to use an overplus of tannic acid, which in a further step of the process must be entirely eliminated, as it would prevent the formation of juice, and be hurtful to the pipes through which the juice flows. In order to guard against the decomposition of the tannic acid, carbolic acid is added.

WEEKLY STATEMENT OF COMPARATIVE

For the Fifty-two Weeks,

	German Beetroot 88 o/o Prompt, free on board.						French Crystals. No. 3. c.f.i.			West India. Good Brown.			Java afloat. No. 15 and 16.		
	1889.		1888.		1887.		1889.	1888.	1887.	1889.	1888.	1887.	1889.	1888.	1887.
n. 4..	13/9	13/10½	15/9	16/-	11/3	11/1½	16/6	18/6	13/9	13/6	15/-	10/9	17/1½	17/6	13/7½
11..	13/9	13/10½	15/6	15/4½	11/1½		16/6	18/3	13/9	13/6	14/6	10/9	17/-	17/3	13/4½
18..	13/7½		14/10½		11/4½	11/1½	16/3	17/6	13/9	13/6	14/-	10/9	16/9	16/-	13/6
25..	13/7½	13/9	14/6	14/7½	11/1½	11/-	16/1½	17/3	13/9	13/6	14/-	10/9	16/3	16/4½	13/6
eb. 1..	13/6	13/7½	14/6	14/10½	11/-	10/7½	16/1½	17/-	13/9	13/6	13/9	10/9	16/4½	16/4½	13/6
8..	13/9	13/10½	14/7½		10/9		16/4½	16/9	13/9	13/6	13/6	10/9	16/4½	15/9	13/4½
15..	13/10½		13/10½	14/1½	10/9		16/7½	16/3	13/6	13/6	13/-	10/9	16/4½	15/3	13/6
22..	14/-	14/1½	14/4½	14/6	10/6		16/9	16/4½	13/6	13/9	13/-	10/6	16/6	15/9	13/-
March 1.	14/3½	14/4½	14/6	14/7½	10/7½		17/-	16/6	13/6	14/-	13/-	10/6	16/7½	15/9	12/9
8..	14/10½	14/7½	14/4½	14/6	10/10½	10/9	17/6	16/6	13/6	14/6	12/9	10/6	17/-	15/9	13/1½
15..	15/-	15/3	14/4½	14/7½	10/9		17/9	16/9	13/6	14/9	13/-	10/6	17/3	15/6	13/3
22..	15/6	15/9	14/4½		10/10½	11/-	18/6	16/9	13/6	15/3	13/-	10/6	17/9	15/9	13/6
29..	17/3	17/4½	14/1½	14/-	11/3	11/4½	19/6	16/9	13/7½	16/-	13/-	10/6	18/9	15/7½	13/6
April 5..	17/3	17/6	13/9	13/10½	11/4½		19/9	16/9	13/9	16/3	12/9	10/6	19/-	15/7½	13/6
12..	18/6	19/3	14/1½	13/10½	11/7½		20/6	16/9	13/10½	17/-	12/9	10/9	20/-	15/7½	13/9
19..	21/3	21/6	13/7½	13/6	11/7½		22/6	16/9	13/9	18/-	12/9	10/9	22/6	15/6	13/7½
26..	23/7½	23/4½	13/3	13/4½	11/7½		24/-	16/6	13/7	19/-	12/6	10/9	24/-	15/7½	13/7½
May 3..	21/4½	23/3	13/-	13/3	11/4½	11/10½	23/-	16/6	13/6	18/-	11/9	10/9	23/6	15/6	13/7½
10..	20/4½	21/6	12/9	13/1½	11/9	11/10½	21/6	16/4½	13/6	18/-	12/-	10/9	23/-	15/4½	13/6
17..	21/-	22/-	13/-	12/9	12/-	11/10½	23/-	16/4½	13/6	18/6	11/9	10/9	23/3	15/4½	13/6
24..	22/-	22/9	13/-	13/1½	11/10½	12/-	23/3	16/4½	13/6	18/9	11/9	10/9	22/-	15/4½	13/3
31..	21/3	23/6	12/10½	13/-	11/6	11/7½	23/9	16/4½	13/6	19/-	11/9	10/9	23/3	15/4½	13/4½
June 7..	22/3	24/6	13/1½	13/4½	11/9	11/10½	24/6	16/6	13/4½	19/-	11/9	10/6	23/6	15/7½	13/6
14..	23/-	25/9	13/9	13/6	12/-	12/9	25/3	16/9	13/7½	19/3	12/-	10/9	25/-	15/7½	13/7
21..	24/-	26/3	13/9		12/3	13/-	25/-	16/9	14/3	19/6	12/-	11/-	25/-	15/7½	13/10½
28..	25/-	28/3	13/10½		12/7½	12/10½	25/9	17/-	13/10½	20/-	12/3	11/-	25/-	15/10½	13/10½
July 5..	27/-	27/6	14/-		12/10½	13/4½	26/-	17/-	13/10½	19/6	12/3	11/-	25/-	15/10½	13/10½
12..	19/3	20/6	14/7½	14/6	13/6	13/3	24/-	17/-	14/-	19/-	12/3	11/-	24/-	16/-	13/10½
19..	23/-	21/6	14/6		13/-	12/7½	23/9	17/-	14/1½	18/6	12/3	11/-	23/-	16/-	13/9
26..	20/-	21/3	14/-		12/6		22/6	17/-	14/1½	18/-	12/-	11/-	22/6	15/9	13/9
Aug. 2..	19/9	19/6	13/10½		12/4½	12/9	21/9	17/-	14/1½	17/6	12/-	11/-	22/-	15/9	13/10½
9..	19/-	19/3	13/10½	14/3	12/6		21/-	17/3	14/-	17/3	12/3	11/3	22/-	16/-	13/10½
16..	18/7½		14/1½	14/3	12/7½	12/9	20/6	17/3	14/-	17/-	12/6	11/3	21/9	16/1½	14/-
23..	16/-		14/4½		12/6		19/9	17/3	14/1½	15/6	12/9	11/3	19/3	16/3	14/1½
30..	15/-	14/6	14/7½	14/4½	12/6	12/7½	19/3	17/3	14/4½	14/6	12/9	11/3	18/-	16/3	14/3
Sept. 6..	13/6	13/10½	14/3	14/7½	12/6	12/7½	18/-	17/3	14/6	13/6	12/9	11/3	16/9	16/6	14/3
13..	14/3	14/7½	14/6	14/7½	12/7½	12/6	17/3	17/-	14/6	14/-	12/9	11/3	17/-	16/6	14/3
20..	14/-		14/9	15/-	11/9	11/7½	17/-	16/9	14/6	14/-	12/9	11/3	17/-	16/6	14/-
27..	13/-	13/1½	14/6	14/-	11/7½	11/10½	16/-	16/3	15/-	13/6	12/9	11/3	16/-	16/6	13/9
Oct. 4..	12/4½	12/7½	13/6		11/10½	12/-	15/3	15/9	15/3	13/-	12/6	11/6	15/6	16/-	14/-
11..	11/10½		13/3		12/-	11/10½	14/-	15/6	14/6	13/-	12/6	11/3	15/-	16/-	14/-
18..	11/6		13/3	13/6	11/10½	12/1½	13/10½	15/9	14/6	12/-	12/6	11/6	14/6	16/-	14/1½
25..	11/1½	11/4½	13/3	13/1½	12/6	12/4½	13/6	15/9	14/7½	11/-	12/6	12/-	14/3	16/-	14/6
Nov. 1..	11/3	11/9	12/9	12/6	12/6	12/7½	13/7½	15/9	15/-	11/-	12/6	12/6	14/3	16/-	14/10½
8..	11/7½	11/9	12/9	13/-	13/4½	13/7½	13/9	15/9	16/-	11/-	12/6	13/-	14/6	16/-	16/-
15..	11/10½	11/6	13/4½	13/3	13/10½	13/9	13/10½	15/9	16/3	11/-	12/9	13/3	14/3	16/6	16/6
22..	11/6		13/6	13/7½	13/4½	13/10½	13/6	16/-	16/6	11/3	13/-	13/3	14/3	17/-	16/3
29..	12/1½	12/-	13/3	13/6	14/3	14/6	14/-	16/1½	17/-	11/6	13/3	13/6	14/9	17/-	16/9
Dec. 6..	12/-	12/1½	14/3	14/4½	15/6	15/3	14/-	16/9	17/9	11/6	13/6	14/-	15/3	17/-	17/4½
13..	12/-	12/7½	13/10½	14/1½	15/-	15/3	13/9	16/6	17/9	11/6	13/6	14/-	15/6	17/-	17/4½
20..	11/7½	11/9	13/9	14/-	15/6	16/-	13/9	16/4½	18/-	11/9	13/6	14/6	15/3	17/-	17/6
27..	11/7½		13/10½		16/3	16/1½	13/7½	16/4½	18/6	11/9	13/6	15/-	15/3	17/-	18/-

PRICES OF RAW AND REFINED SUGAR

January to December 1889-8-7.

	Tate's Cubes.			Martineau's Titlers.						Say's Loaves, f.o.b.			Lebaudy Loaves, f.o.b.		
	1889.	1888.	1887.	1889.		1888.		1887.		1889.	1888.	1887.	1889.	1888.	1887.
Jan. 4..	21/6	22/3	19/-	19/6		21/-	21/3	17/-		18/3	19/9	15/6	18/-	19/6	15/-
11..	21/6	22/-	19/-	19/6		20/9	21/-	17/-		18/3	19/6	—	17/9	19/6	—
18..	21/6	21/6	19/3	19/3	19/6	20/6		17/3		18/-	19/-	—	—	19/-	15/3
25..	21/6	21/6	19/-	19/3	19/-	20/-	20/3	17/3		18/-	—	15/6	17/6	18/6	15/3
Feb. 1..	21/6	21/3	19/-	19/3		20/-		17/3		18/-	18/3	—	17/4½	—	—
8..	21/6	21/-	18/9	19/3		19/6	19/9	17/-		18/-	18/-	—	17/6	17/9	15/-
15..	21/6	20/9	18/9	19/3		19/-	19/3	17/-		18/-	17/3	15/3	17/6	17/3	—
22..	21/-	20/9	18/9	19/3		19/-	19/3	17/-		18/-	17/9	—	17/6	17/4½	—
March 1..	21/-	20/9	18/9	19/6		19/3		17/-		18/6	18/3	—	17/9	17/7½	14/9
8..	21/9	20/9	18/9	20/-		19/3		17/-		19/-	18/-	—	18/4½	—	14/9
15..	21/9	20/6	18/9	20/-		19/-		17/-		19/-	—	—	18/6	—	14/9
22..	22/3	20/6	18/9	20/6		19/3		17/-		19/6	18/-	—	—	—	14/9
29..	23/3	20/6	18/9	21/3		19/3		17/-		20/6	17/9	—	—	—	14/9
April 5..	23/6	20/6	19/-	22/-		19/3		17/-		20/9	17/6	—	—	—	—
12..	24/9	20/6	19/3	23/3		19/3		17/-		21/-	17/6	—	21/-	—	—
19..	26/-	20/6	19/-	25/-		19/3		17/-		24/3	17/9	—	24/3	17/6	—
26..	27/6	20/9	19/-	26/-		19/6		17/-		24/9	17/6	—	—	—	—
May 3..	27/6	20/9	18/9	25/9		19/3		17/-		24/9	17/6	15/-	—	17/3	14/9
10..	27/-	20/6	19/-	25/-		19/-	19/3	17/-		24/-	17/6	—	23/-	17/3	14/9
17..	26/-	20/6	18/9	25/-		19/-	19/3	17/-		23/9	17/6	—	—	17/3	14/10½
24..	26/-	20/6	18/9	25/9		19/-	19/3	17/-		24/-	17/6	—	—	17/3	14/10½
31..	26/3	20/6	18/9	26/-		19/-	19/3	17/-		24/-	17/9	—	—	17/4½	14/10½
June 7..	26/9	20/6	18/9	27/-		19/6	19/9	17/-		24/-	17/9	—	—	17/4½	14/10½
14..	27/9	21/-	19/-	27/6		19/9		17/-		25/6	18/-	—	—	17/9	14/10½
21..	28/-	21/-	19/3	27/9		19/9		17/-		26/-	18/-	15/3	—	17/10½	15/-
28..	29/-	21/3	19/3	28/9		20/-		17/-		27/-	18/3	15/-	—	18/-	—
July 5..	29/-	21/-	19/3	29/-		20/-		17/3		26/6	18/3	15/-	—	18/-	—
12..	28/6	21/-	19/3	28/6		20/-		17/3		26/6	18/6	—	—	18/3	15/-
19..	27/-	21/-	19/3	27/-		20/3		17/3		24/9	18/9	15/-	—	18/3	—
26..	27/-	21/-	19/3	26/6		20/3		17/3		24/3	18/9	19/-	23/9	—	—
Aug. 2..	26/6	21/-	19/-	25/9		20/3		17/3		23/9	18/6	15/-	23/3	—	—
9..	26/6	21/6	19/-	25/6		20/3		17/3	17/6	23/6	18/6	15/-	—	—	15/1½
16..	26/-	21/9	19/-	24/9		20/6		17/6		23/-	18/6	15/3	22/9	18/6	15/3
23..	25/-	22/3	19/6	24/-		20/6		17/9		22/6	18/9	15/4½	—	18/6	15/3
30..	25/-	22/3	19/6	23/9		20/3	20/6	17/9		20/9	19/-	—	—	—	15/6
Sept. 6..	24/-	21/9	19/6	23/-		20/-	20/3	17/9	18/-	20/9	19/-	15/6	20/-	—	15/3
13..	23/-	21/6	19/6	22/6		20/-		17/6	17/9	20/-	19/-	—	—	—	15/9
20..	23/-	21/6	19/3	22/6		20/-		17/6	17/9	20/-	18/9	15/6	—	18/6	—
27..	23/-	21/6	19/-	22/-		19/9		17/6		19/9	18/6	—	—	—	—
Oct. 4..	22/-	21/-	19/3	21/-		19/6		17/6		19/-	18/3	15/6	—	18/-	—
11..	21/6	21/-	19/6	20/6		19/3		17/6		18/-	18/3	15/6	16/9	17/6	—
18..	21/6	21/6	19/9	20/-		19/3		17/6		17/9	18/9	15/9	16/9	17/6	—
25..	21/3	21/-	20/-	19/6		19/-	19/3	17/9		17/6	18/-	16/-	16/6	17/6	—
Nov. 1..	20/9	21/-	20/-	19/-		19/-	19/3	17/9		17/-	18/-	16/-	16/6	17/6	—
8..	20/6	21/-	21/-	19/-	19/6	19/-	19/3	19/-		17/-	18/-	17/3	—	17/4½	17/1½
15..	20/-	21/3	21/3	19/-		19/-	19/3	19/3		17/-	18/3	18/-	—	17/7½	17/7½
22..	20/-	21/3	21/-	19/-		19/3		19/-		16/6	18/6	18/-	—	17/9	17/7½
29..	20/6	21/6	21/6	19/-		19/3		19/6		16/6	18/6	18/3	—	18/-	17/9
Dec. 6..	21/-	22/-	22/-	19/-		19/6		20/-		16/9	18/9	18/9	—	18/-	18/9
13..	21/-	22/-	21/6	19/-		19/6		20/-		—	18/6	18/9	—	18/-	18/9
20..	21/-	21/9	22/-	18/9		19/6		20/6		—	18/6	19/-	—	18/-	19/-
27..	20/6	21/9	22/6	18/6		19/6		21/-	21/6	—	18/6	19/9	—	18/-	19/6

H. H. Hancock & Co., 27 Mincing Lane, London, E.C.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

January to December 31st.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1888.	1889.	1888.	1889.
	Cwts.	Cwts.	£	£
Germany	5,320,106	5,804,488	3,495,698	4,489,165
Holland..................	283,549	420,376	182,577	344,318
Belgium	694,302	1,284,397	437,331	826,495
France	37,367	592,390	27,398	402,139
British West Indies & Guiana	2,140,438	1,880,576	1,725,522	1,768,593
British East Indies	1,006,913	1,720,579	483,865	1,169,678
China and Hong Kong	10,733	51,334	6,420	38,346
Mauritius	256,463	307,882	173,372	294,312
Spanish West India Islands	304,496	49,735	223,544	44,370
Brazil	2,267,225	720,638	1,425,784	513,745
Java	3,612,487	2,327,212	2,704,310	1,989,812
Philippine Islands	722,425	1,033,649	345,317	611,929
Peru	497,142	701,853	369,075	564,473
Other Countries	696,725	648,457	507,154	568,718
Total of Raw Sugars ..	17,850,371	17,543,566	12,107,367	13,626,084
Molasses	346,025	396,210	109,485	146,503
Total Sugar and Molasses	....	....	12,216,852	13,772,587
Refined Sugars.				
Germany	3,177,340	4,140,325	2,768,246	4,107,883
Holland..................	1,426,276	1,355,913	1,290,654	1,352,133
Belgium	203,888	252,798	193,316	264,173
France	1,570,237	2,633,000	1,376,741	2,512,917
United States	41,628	10,201	38,960	9,981
Other Countries	*470,479	*631,702	*375,559	*633,010
Total of Refined	6,889,848	9,023,939	6,043,476	8,880,097

EXPORTS.—Refined Sugars.

	Cwts.	Cwts.	£	£
Sweden and Norway	81,751	95,326	68,136	81,189
Denmark	102,946	141,896	75,639	104,773
Holland	92,665	102,289	66,798	81,773
Belgium	31,734	29,067	21,569	21,791
France	7,393	7,658	5,186	5,840
Portugal, Azores, & Madeira	79,200	96,220	56,607	74,629
Italy	93,061	107,936	68,860	88,883
Other Countries	195,292	175,201	152,047	150,292
Total of Exports	684,042	755,593	514,842	609,170

* Imported almost entirely from Russia.

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of December, 1889, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1886, 1887, and 1888, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				Dec.	Dec.	Dec.	Monthly Average.				Dec.	Dec.	Dec.	Monthly Average.				Dec.	Dec.	Dec.
	1886	1887	1888	1889	1887	1888	1889	1886	1887	1888	1889	1887	1888	1889	1886	1887	1888	1889	1887	1888	1889
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France.............	1462	1363	1686	2373	1451	1792	4111	2688	5099	4855	8595	4146	16853	17662	4150	6462	6511	10969	5597	18645	21803
Holland	3508	3780	3267	2294	3918	3943	2168	1428	2483	2675	3354	3949	3122	4189	4936	6263	5942	5648	7867	7065	6357
Germany & Austria ..	990	1347	1510	2573	1390	3277	3232	6634	10463	11729	13844	22359	25803	19582	7624	11810	13239	16117	23749	29080	22814
Belgium	344	592	622	827	508	1012	1597	113	308	227	225	590	368	307	457	900	849	1052	1098	1380	1904
United States	854	454	8	..	..	..	..	5078	2804	157	42	261	56	8	5932	3258	165	42	261	56	8
Russia	..	3	..	23	..	..	..	3412	452	1959	2015	500	3663	10	3412	455	1959	2038	500	3663	10
Other Countries	..	..	1	239	..	..	..	9	15	2	355	180	..	..	9	15	3	594	180	..	..
Total	7158	7539	7094	8329	7267	10024	11138	19362	21624	21604	28431	31985	49865	41758	26520	29163	28698	36760	39252	59889	52896

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

TO JANUARY 18TH, 1890 AND 1889. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS. 1890.	STOCKS. 1889.	DELIVERIES. 1890.	DELIVERIES. 1889.	IMPORTS. 1890.	IMPORTS. 1889.
London	46	34	18	26	17	31
Liverpool ..	82	91	22	21	18	14
Clyde	41	34	14	14	14	24
Bristol	4	4	7	5	6	5
Total ..	173	163	61	66	55	74
	Increase.. 10		Decrease.. 5		Decrease .. 19	

The above figures do not include Hull, Leith, &c., for which there are no published returns.

SUGAR STATISTICS—UNITED STATES.

FOR THE FOUR PORTS—NEW YORK, BOSTON, PHILADELPHIA, AND BALTIMORE,—1889, 1888, 1887. IN TONS.

	Imp'rs Stocks on 1st.			Deliveries.			Imports.		
	1889.	1888.	1887.	1889.	1888.	1887.	1889.	1888.	1887.
January ..	32254	47798	102279	73788	67682	74708	78221	76821	66505
February..	36687	56937	94076	59711	71006	77164	58838	87447	71176
March	35814	73378	88088	108992	81328	118939	94059	103235	113209
April	20881	95285	82358	131950	89086	136470	126161	108558	165224
May	15092	114757	111112	115124	95999	126116	123468	122475	172344
June	23436	141233	157340	94182	118209	91476	101518	120472	118868
July	30772	143496	184732	109354	122194	96792	128697	90166	82323
August....	50115	111468	170263	86422	111965	104914	82742	81971	88125
September.	46435	81474	153474	56311	102276	98182	43829	77670	57858
October ..	33953	56868	113150	65621	71384	100001	61360	64516	58670
November.	29692	50000	71819	69580	56189	73185	51869	43527	58188
December.	11981	37338	56822	58860	112415	67175	58048	107331	58151
Total Tons.	—	—	—	1029895	1099733	1165122	1008810	1084189	1110641

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 31ST DECEMBER, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	German Empire.	Austria.	Remaining four principal *entrepôts*.	TOTAL 1889.	TOTAL 1888.	TOTAL 1887.
175	240	62	502	284	23	1286	898	973

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST DECEMBER, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	German Empire.	Austria.	Remaining four principal *entrepôts*.	TOTAL 1889.	TOTAL 1888.	TOTAL 1887.
1298	495	35	426	248	352	2854	2738	2735

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.	1886-87. Tons.
France..........	750,000 ..	466,767 ..	392,824 ..	485,739
German Empire ..	1,220,000 ..	990,604	959,166 ..	1,012,968
Austro-Hungary..	730,000 ..	523,242 ..	428,616 ..	523,059
Russia and Poland.	480,000 ..	537,000 ..	441,342 ..	487,460
Belgium	195,000 ..	145,804 ..	140,742 ..	135,755
Holland	60,000 ..	46,040 ..	39,280 ..	36,098
Other Countries..	60,000 ..	55,000 ..	49,980 ..	49,127
Total....	3,495,000	2,764,457	2,451,950	2,730,206

Mr. Licht's present estimate is 50,000 tons in excess of his figures of last month, the increase being in the estimate of the French crop.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

Since the opening of the new year, business has been, as is not uncommon at this time, somewhat inactive. Buyers are operating from hand to mouth, and business for future delivery is neglected. Considering the sluggish tendency, prices have been fairly well maintained, but must be reported slightly lower all round, yet the recovery established in December has not been fully lost. There appears to be no pressure to sell, the prevailing feeling may be characterised as one of indecision.

Refined sugars are lower all round.

In beet sugars some effect was produced in the middle of the month by the estimate of the coming crop being again raised by 50,000 tons. The quantity in excess of last year will be according to Mr. Licht, 730,000 tons; according to Mr. Goerz, 632,000 tons. Still prices of beet have not receded, and remain tolerably firm. The consumption has been increasing in nearly every country, and is likely to take off a good deal of the surplus beet, while the production of cane is certain to be inferior to the preceding year. The import of French raw sugars for refining continues active. Imports into the United Kingdom are slightly behind those of last year, while the stocks are 10,000 tons more than at the corresponding period in 1889.

Present quotations for the standard qualities, as under, are :—

FLOATING.			Last Month.
Porto Rico, fair to good Refining	12/6 to 13/6	against	13/- to 14/-.
Cuba Centrifugals, 97°/ₒ polarization	14/3	,,	14/6
Cuba, fair to good Refining	12/9 to 13/3	,,	13/- to 13/6.
Java, No. 14 to 15 D.S...	14/9 to 15/-	,,	15/- to 15/3.
British West India, fair brown..	11/6	,,	12/-
Bahia, low to middling brown	10/- to 10/6	,,	10/3 to 10/9.
,, Nos. 8 to 9	11/- to 11/6	,,	11/3 to 11/9.
Pernams, regular to superior Americans..	10/6 to 12/3	,,	10/6 to 12/3.
LANDED.			Last Month.
Madras Cane Jaggery..	9/3	against	9/6.
Manila Cebu and Ilo Ilo	9/-	,,	9/-

Paris Loaves, f.o.b...	16/9	against	17/-
Russian Crystals, No. 3, c.i.f.	Nominal		
Titlers	18/6	,,	19/-
Tate's Cubes..	20/-	,,	21/-
Beetroot, German, 88%, f.o.b..	11/7½ to 11/9	,,	11/7½ to 11/9

THE
SUGAR CANE.

No. 248. MARCH 1, 1890. Vol. XXII.

☞ The writers alone are responsible for their statements.

Cheques and P.O. Orders to be made payable to The Proprietor, 6, Ward's Buildings, Deansgate, Manchester. All other communications to be addressed to The Editor, at the same address.

For Table of Contents, see page i.

The Mauritians resident in Paris entertained the new Governor, Sir Charles Cameron Lees, at a banquet at Voisin's restaurant, on the occasion of his passage through Paris.

The Jamaica Exhibition, which is to be held next year, is progressing steadily according to latest accounts. The guarantee fund already amounts over £23,000. The Governor has stated that the country will see to the Exhibition being properly carried out, and they did not propose to ask the State to do anything in the way of state balls, illuminations, &c. He wished to impress on the people of Jamaica that they must at once make preparations for sending all kinds of products—natural, agricultural, and manufactured. A proposition to establish a representative Jamaican Industrial Village as a feature of the Exhibition met general approval.

The diffusion system is apparently gaining ground in Cuba, as will be seen from a paragraph on page 130. The *Louisiana Planter*, after an interesting and instructive review of the results of the diffusion system in that State, a condensed version of which will be found on page 149, sums up as follows :—

While diffusion will go far towards placing Louisiana sugar cane on an equal footing with the beet root of Europe, it will place it at a permanent and decided advantage over sugar cane in the tropics, where, for the most part, water is either wanting for this process or coal so high priced as to compromise its employment. Perhaps we might best wish it impossible ever to burn the exhausted chips in economic practice. With these as a purely waste product, and coal

at $15 per ton, our good, high-tariff friends of the Sandwich Islands, for example, would have reason to adhere to their mills. It is quite different upon our rivers and bayous, with coal at $4.50 per ton on the grates.

These remarks we recommend to the consideration of those who may be ready to assume, off hand, that because diffusion may be paying in Louisiana, it will therefore also pay where the conditions as to cost of fuel and water supply are totally different.

We take the following from Messrs. Willett and Gray's circular:—An important movement has been begun for bringing under cane cultivation large tracts of land in Florida. A central factory is established, and will produce 1,000 to 1,200 tons sugar this season. Skilled Cuban labour may be invited to settle on these lands, such labour being the best adapted for quickest development. The land itself is reported by Cuban experts to be of wonderful richness and adaptation for immense cane fields, and with no fear of frost. The news from Cuba is quite important and serious. Fears are expressed of very serious damage to the present crop by reason of the long-continued drought, and estimates, already reduced to 600,000 tons, are subject to much further reduction. Other West Indies may suffer also to more or less extent. The Philippine Islands crop is quite late this season, and no business is yet reported.

We have received from Messrs. Robert Deeley & Co., of New York, a magnificent illustrated catalogue of the sugar manufacturing machinery which they produce. They seem to do these things better, we mean the advertising part of the business, in the States than we do here, there is certainly no part of the world where the value of printers' ink is so thoroughly understood.

Our attention has been called to the fact of some articles from the *Louisiana Planter* having appeared in our columns without acknowledgment. We hasten to mention the fact, as we are in no way anxious to obtain credit for reports and statements which we could not ourselves possibly obtain in so complete a form as they are presented by the excellent and ably conducted journal in question. Amongst the papers which were derived from this source are the paragraph on "Sugar as a Remedy for Boiler Incrustation" in our

January issue, and the long and instructive report on "The Sugar Industry in the Philippine Islands" in our last number.

It is interesting to hear that the Louisiana Sugar Planters' Association is about to discuss the relative profit of extraction by diffusion and by the cane mill. We hope to give a summary of this discussion in our next number. The *Louisiana Planter*, from which we obtain this information, has made some preliminary remarks relative to the difficulty which all new processes have had to encounter in Louisiana, owing to the mere fact of their novelty. We do not suppose the conservative feeling is any weaker in our colonies than on the American continent, rather the contrary, indeed; but it is not a mere question of obstinate adherence to accustomed routine and dislike to change. The question of how sugar can be more cheaply produced, or, what is much the same thing, how the utmost available sugar can be most economically extracted from a given weight of canes is one that is vital as regards the existence of the sugar industry in many of the colonies. In view of the ever-increasing production of beet sugar under the artificial stimulus of the bounty system, and the uncertainty as to any speedy abolition of that system, it is quite evident that we cannot look with any reasonable confidence to any permanent advance in the price of sugar in the English market. Although accurate details of cost of production, such as are easily obtainable in the case of beet sugar, are almost entirely wanting in the case of cane sugar, yet it is hardly doubtful that the present low prices now obtainable by our planters are not, to say the least, very remunerative, and, therefore, as already said, the question of which process shall be adopted cannot be said to be one of sentiment, but must be settled by facts and figures. We therefore thoroughly endorse the remarks of the *Louisiana Planter* to the effect that the enquiry as to whether the employment of diffusion promises equal or superior profits to its rival is both legitimate and pertinent. Further, that the final judgment as between battery and mill extraction must rest at the juice extracted, the only criterion of technical excellence being the percentage of total sugar present in the cane which is secured in the form of juice, diffusion not being made accountable any more than the cane mill for waste or unskilfulness in any process subsequent to the extraction. That, as commercial processes, the ultimate judgment as between the two can rightfully rest on such cases only as

present practically complete financial factory accounts, from which difference of intrinsic value in raw materials, difference of skill in handling the juice, syrup, sugar, or other products, and difference in the price paid for manual labour, fuel, freights, and the like, are essentially eliminated. And, lastly, that it is manifestly unfair to compare either the industrial yield or the net cash return of admittedly the best arranged and most systematically conducted establishment that can be found with those of any ordinary sugar house temporarily demoralised by new processes, new mechanisms, and, for the most part, new operatives.

It is evident that the difficulties in the way of arriving at an exact decision are by no means inconsiderable, one thing is certain, no colonial sugar producer (possessing the means of purchasing new machinery) who is not blind to his own interests can afford to neglect the opportunity of information afforded by the discussion under notice. How far the results obtained can be utilised for other and more tropical climates than those of the Southern States of North America must be left to the final decision of the colonial planters themselves.

In connection with the proposed changes in the French sugar legislation, a demand is being made that the refiners should be made to bear their part in the burdens of the country more equitably than has hitherto been the case. It is no secret that for years, owing to perfect combination and the clever management of such eminent tacticians as M. Léon Say and others, almost equally astute, the refiners have been netting very large profits, the manufacturers of raw sugar and the beet cultivators having been kept neutral by the action of the refiners in supporting those protective measures which have made sugar growing and manufacturing a success. But now that the French Government is compelled to curtail the profits of the latter class, being credited with the intention of increasing the legal yield and diminishing the *excédents*, the *Journal des Fabricants de Sucre* and others are pointedly suggesting that it is high time the refiners were looked after, and are quoting precedents and referring to former legislation in that direction. We refer our readers to the articles entitled "The Position of the French Sugar Manufactures, &c." (page 120), and French Sugar Legislation" (page 118). We would also, in connection with the question of Bounties on Foreign Sugar, call attention to the instructive little dispute which has sprung

up between the German publicists, Messrs. Goerz and Licht, and the Belgian and French journals (see articles "German Opinion on the French and other bounties" and "The Statements of Mr. Goerz" (page 128). The partisans of the London Convention will hail these statements with some satisfaction, even though there is nothing particularly new in them, as evidences that the question is not losing ground in public or international interest; some may possibly be pardoned for recalling the old and true saying, "When thieves fall out honest men get their own."

The *Deutsche Zuckerindustrie* applauds the initiative of the Belgian Committee, but thinks that they have not sufficiently considered the financial bearing of the question. The same paper is of opinion that the utterances of the Government officials in the English Parliament on the 13th instant warrant the conclusion that they have no very great faith in the ultimate carrying out of the Convention.

The following is from the *Barbados Globe*:—

"Re-appraisements of plantations in Chancery, and sales out of Chancery, continue to be of frequent occurrence. Recent sales are *Frere Pilgrim*, in Christ Church, which was sold to C. T. Cottle, Esq., M.C.P., for £12,400; *Saltram*, in the parish of St. Joseph, to T. E. Reece, Esq., for £8,310 9s. 10d.; and *Dayrells*, in the parish of St. Michael, to Mrs. Marion West, for £3,750 15s. 4d. There was much competition before *Frere Pilgrim* was knocked down to Mr. Cottle. It is a sign of reviving prosperity and of confidence in landed property, and these sales are now effected, and that there is competition when they occur."

We have pleasure in calling attention to some statistics relative to the working of a West Indian Raw Sugar Factory which will be found in our present number. Such statistics as these are somewhat difficult to obtain, and it is possible that some of our readers may consider the details too minute. Yet these apparently insignificant minutiæ have their value, when it comes to close calculation of profits, as in the present case of competition between the beet and cane sugars, indicating where there may perhaps be a possibility of reducing the cost of production. We are indebted for these details, which we believe may be relied on as accurate, to the kindness of a valued contributor, Mr. George Stade, who has had some years

practical experience in the West Indies, &c., and has now established himself as chemical engineer, adviser, and agent for the purchase of machinery, in Berlin.

Once more we hear of electric sugar refining; and content ourselves with referring to the tolerably full description of the "Bauder Electric Process" to be found on page 151.

FRENCH SUGAR LEGISLATION.

The *Economiste Français*, one of the most liberal of the high-class French journals, and generally considered to be strongly in favour of free trade, has an article on the sugar legislation of that country, especially the law of 1884, which is interesting as affording some means of judging how far there is any likelihood of France joining the Convention. We, therefore, translate *in extenso* that portion which relates to the sugar question.

At the outset we would remark that the deficits (of which the Treasury complain) are absolutely illusory, and that the Treasury receives on sugar exactly the return which was anticipated at the time the law of 1884 was voted. In fact, M. Tirard, in his speech of 8th July, 1884, complained that the amount yielded by the sugar tax was constantly diminishing, and demanded that the new law should secure to the Treasury the receipt of 151 million francs. Now, in the five financial years, 1884-88, the Treasury received 757 million francs, which is exactly 151 millions annually. The accounts of the last campaign are not yet closed, but as the balance on the 31st December, 1889, was 139 millions, and as this provisional balance has in previous years always been increased by 10 to 15 millions, the Treasury will again receive in 1889 what it claimed in 1884.

But while the Treasury loses nothing directly on the receipts from sugar, it obtains indirectly an enormous profit by the prodigious development attained by the beet cultivation and the sugar industry under the régime of the new law. The area of beets sown, which in 1883 had fallen to 120,000 hectares (300,000 acres) and was still diminishing, has risen to 200,000 hectares (500,000 acres). The gross return per hectare has risen from 700 to 1,000 fr. The production of sugar, which had fallen to 350,000 tons, has this year reached 750,000 tons.

We have here a creation of wealth on a colossal scale, especially when we consider that to cultivate annually 200,000 hectares (500,000 acres) of beets, at least four times that quantity must take part successively in their production and in the profit resulting from this method of cultivation.

The selling value of the land and the rates of farming charges have risen 20 per cent. in the northern district; the carrying companies and coal merchants are scarcely able to satisfy the needs of the sugar manufacturers.

The Government can easily form an idea of the progress of the receipts from registration in the sugar producing departments, and of the amount of the resources which the budget of the State has derived from this grand movement.

The consumer also has benefited by the legislation of 1884, by getting cheaper sugar. In fact, while on the one hand the quantity of sugar produced has increased, on the other hand, as a natural consequence of the progress of the cultivation and manufacture, the cost and selling prices of sugar have materially diminished. Further, France is now exporting enormous quantities of sugar, both raw and refined, in place of having to seek elsewhere the complement of its consumption.

It would then be rash to meddle any further with the law of 1884.

We should follow the example of Germany, which did not interfere with its beneficent legislation until its agriculture and its industry, rehabilitated and armed for the struggle, were able to bear a reduction of the premiums. But Germany took fifteen years to do this, and our law is only five years old.

Now in spite of this reduction the German bounty is equal if not superior to our own. The Germans have a beetroot which is richer than ours, and get from a ton of roots, for which they pay less than we do, 20 kilos. (44lbs.) more sugar, worth at least 6 frs. (4s. 10d.), which added to the legal bounty of 4 frs. (3s. 3d.) gives a total premium of 10 frs. (8s. 1d.)

The same is the case in Austria.

Belgium gives 10½ frs. per sack to her manufacturers.

Our competitors therefore have premiums equal or superior to ours, and they have the immense advantage of having long ago effected the transformation of their machinery.

THE POSITION OF THE FRENCH SUGAR MANUFACTURERS AND REFINERS WITH REGARD TO THE SUGAR DUTIES.

From the *Journal des Fabricants de Sucre.*

The articles which have been devoted in this journal to the examination of the position of the beetroot cultivators, the sugar manufacturers, and the refiners, in which we have endeavoured to give prominence to the excessive privileges enjoyed by the refining industry, to the detriment of the agricultural sugar industry, the consumer and the Treasury itself, have begun to bear fruit. For example, the *Economiste Français,* a journal hitherto opposed to the legislation of 1884, is now enlarging with satisfaction upon the merits of the tax upon the beet, and after enumerating at length the services rendered to the country by the beet cultivation and sugar manufacture, concludes by declaring that it would be imprudent to meddle again with the law of 1884. Our contemporary does not as yet demand the application of the law of the 14th of March, 1874, relative to the fiscal supervision of the refining industry. But we venture to hope that a thorough examination of the question will convince them, as it has us, of the utility and the equity of this measure, in favour of which, amongst others, an influential body like the Chamber of Commerce of St. Quentin has just passed a formal resolution.

In certain quarters, it is beginning to be perceived that an industry which is really valuable, useful, and productive of wealth, such as the agricultural sugar industry, cannot, without danger to the interests of the Treasury and of the country, be subjected to fresh taxation, or undergo incessant changes in legislation, and that the time has come for requiring the secondary industry of refining to bear its legitimate part of the public burdens.

Although we have already on several occasions pointed out the profound difference between the agricultural sugar industry and that of refining, from an economic and also from a fiscal point of view, we think we shall do well to return to this question, in order to show that if any new tax must be levied on sugar, it is by suppressing the premiums of the refiners, by the fiscal supervision of the refineries, and, if necessary, by the adoption of even more radical measures, that this tax can be levied without arresting the cultivation of the beet or

the manufacture of sugar, and without striking a blow at the development of the refining industry.

In the present condition of the sugar industry, what are the respective conditions of the cultivator, the manufacturer, and the refiner? In what manner would the projected or proposed alteration in the legislation modify this position? These are, according to our ideas, the points to be cleared up before any alteration in the mode of levying taxation on sugar.

The cultivation of beetroot extends over an area estimated at about 200,000 hectares (80,000 acres.) The amount expended in the production over this area of the quantity of beets necessary for the supply of the manufactories reaches a considerable figure. It is generally admitted that the average expense of cultivation per hectare is 650frs. (£10 8s. per acre,) viz.:—

	frs.
Rent	90
Taxes..	25
Preparation of the soil	75
Manure (chemical and other)	240
Seed and sowing	30
Singling and taking-up..	100
Cartage..	50
General expenses	40
Total	650

Applying this expenditure of 650frs. to the 200,000 hectares of beets cultivated, we get the figure of 130,000,000frs. (£5,200,000.) This is the sum required for the cultivation, in order to supply the manufactories with about 6,000,000 tons of beets. Of this sum, no less than 45,000,000frs. (£1,800,000) comes under the head of manual labour. We see by these figures how great must be the influence of the cultivation of the sugar-beet on the wellbeing of the agricultural population, and on the prosperity of chemical manure manufacturers, seed growers, agricultural instrument makers, &c.; and an examination of this table will easily show the disastrous consequences which would be brought upon these various industries by a reduction of the area under cultivation, consequent on either the lowering of the selling price of beets or the fear that alterations in the legislation might put a stop to the development of the sugar industry.

We are dealing here with actual figures and not with hypotheses; and therefore anyone can calculate what would be the cost to the national wealth of a depression in the beetroot cultivation.

We have seen that the cultivation involves an annual expenditure of 130,000,000frs. What are the receipts? For an average year we can hardly assume a higher yield than 30,000 kilos. of beets of good quality (12 tons per acre,) with 40 per cent. of pulp, which is equal to

30,000 kilos. of root, at 30frs.	900
12,000 kilos. of pulp, at 5frs.	60

For 200,000 hectares, the value of these products amounts to not less than 192,000,000frs. The nett profit per hectare on the cultivation will then be 190frs. (£31 1s. per acre.)

Let us suppose that the sugar manufacturer finds himself compelled to reduce the price which he pays for beets by three or four francs per ton (and we shall see further on how he would be inevitably compelled to do this by the adoption of the projects with which the Government is credited,) in this case the profit on the cultivation would be reduced to 70frs. per hectare, or 14,000,000frs. for the entire beetroot cultivation.

Can we believe that our 40 or 50,000 beet cultivators, who are also consumers of bread, meat, wine, clothing, sugar, coffee, &c., could bear a diminution of income amounting to 24,000,000frs. (£96,000,) without changing their habits of life, or that they would not reduce their household expenditure to a very great extent? We think not. It is even probable that they would economise much further than this; they would use less manure, they would reduce the amount of labour applied in the cultivation; and, as a matter of fact, it would be the fertility of our soil, that is to say the very source of the wealth of more than twenty departments, which would suffer, to the great detriment of the national treasury. When we add that the reduction of the beetroot cultivation would also result in a reduced production of wheat, that, further, less pulp and consequently less meat would be produced, we believe we shall have furnished a tolerably complete picture of what would be the cost to France of the projected re-arrangement of the fiscal régime with which the Government is credited.

Let us now examine the position of the sugar manufacturer. The beets cost him 30frs. per ton; he hands over the pulp and the scum to the cultivator, the molasses to the distiller, the whole representing about 8frs. per ton of beets. The expenses of manufacture may be

estimated at an average of 15 to 17frs. In many cases they are more. These expenses are about as follows:—

	frs.
Coal	4·00
Wages	3·00
Lime, bags, oil, mastic, lighting, laboratory, and various expenses	9·00
Total	16·00

Deducting 8frs. for secondary products there remain 8frs., to which we add 30 francs, the cost of the beets. The net expenditure per ton of beets thus amounts to 38frs. for a yield of 115 kilos. of raw sugar, which brings the cost price per 100 kilos. of sugar to 33frs. (about 13s. per cwt.). As raw sugar is worth from 29 to 32frs. the profit of the manufacturer is *nil.*

There can be no doubt that at the present prices of beets and of sugar the sugar manufacturers could be ruined were it not for the premiums. We can fancy a good many economists saying to us: If sugar is too cheap, make less, or pay less for the beets. We reply, These solutions are impracticable, for if a low price is paid for good beets then the cultivator will be ruined, he will diminish his sowings or will cease to grow beets, and the manufacturer will see his general expenses increase, his existence threatened for want of sufficient supply. Produce less sugar? but you forget that Germany, Austria, Belgium, Holland, &c., are ready to make up the deficit in our production, and to take our place in those markets where we have with difficulty acquired a footing. You forget that these countries are producing very superior beets at 20 or 22frs. the ton, that their manufacturing expenses are less than ours, and that their cost price consequently permits them, even with reduced premiums, to compete successfully with us in the general market. Our manufacturers have to take into account both the necessities of this competition and the exigencies of the French cultivation, the economical conditions of which in no way resemble those which obtain in Germany, Austria, Belgium, or Holland. The profit on manufacturing in the French factories being *nil* at the present prices of beets and of sugar, there being no possibility of reducing the price of the raw material without danger, and the price of sugar being regulated by general competition, it is perfectly evident that the sugar manufacturers are not in a

position to bear any fresh fiscal charges. It is the province of the State to properly appraise the services which are rendered to the country by the great agricultural sugar industry, and to set against the amount which would be produced by the new duty which it contemplates, the millions which this fresh burden would cause both the cultivators and the sugar industry to lose.

We have just seen that the advantages granted to the sugar manufacturer by the legislation at present in force constitute his only profit. Taking everything into account we can scarcely estimate at more than 7 to 8 per cent. the interest on the capital engaged in the sugar industry. If the State should demand a new tax upon that industry, it will in reality be levied on the income of the proprietors of sugar factories, on that of the cultivators, on the wages of the industrial and agricultural population, and the after-effect will be that it will strike at the very vitality of all those branches of industry and commerce which are connected with the cultivation of the beet and the manufacture of sugar.

This is the truth of the matter, and yet, if the government were only willing, it would be so simple and so easy to obtain the fresh supplies required by the Treasury without meddling with the agricultural industry, without retarding its development, in a word without drying up this abundant source of wealth. All that would be needed would be to once more bring the refining industry under the operation of the law common to all, to abolish the privileges which it has for so many years enjoyed and abused to the detriment of the interests of the producers and consumers of sugar and of the Treasury. To apply the law of the 14th March, 1874, *i.e.*, to bring refineries under fiscal supervision, and to cause the State to profit not only by the 12 to 15,000,000 of premiums which the refiners now get, but also by the tax of 20,000,000frs. which the Syndicate of Refiners annually levies on the French consumer by favour of the prohibitive surtax which closes our market to foreign refined sugars. It is a question, in fact, of the State collecting a revenue of some 30,000,000frs., which now escapes it because of the defects in the mode of levying the sugar duties.

FOREIGN SUGAR BOUNTIES.

DEPUTATION AT THE FOREIGN OFFICE.

On the 7th ult. a deputation of workmen interested in the sugar refining industry waited upon Sir J. Fergusson at the Foreign Office to urge the Government to introduce legislation in the coming session, to secure the ratification of the International Sugar Bounty Convention. Delegates attended from Manchester, Liverpool, Bristol, Derby, Nottingham, Glasgow, Greenock, Leith, London, and Plymouth, and the deputation presented a memorial addressed to Lord Salisbury, which said:—

Your memorialists most earnestly desire to impress upon your lordship the grave issues involved to home and colonial labour by the maintenance of the foreign beet sugar bounty system, a system which is wholly indefensible, and which is not seriously justified by the foreign bounty giving powers themselves, but which nevertheless has robbed and still continues to rob upwards of 50,000 British artizans and labourers of permanent work and wages annually, besides inflicting irreparable injury upon her Majesty's cane sugar producing colonies, and, moreover, constituting a standing menace to every other native industry throughout Great Britain, Ireland, and our colonial Empire. The ratification of the Sugar Convention of 1888 and the enactment by Parliament of the necessary legislative provisions to give the convention due operation is now urgently necessary. Whilst before the era of the sugar bounties, when the conditions of Free-trade and no protection prevailed, the imports of beet sugar were only 5 per cent., and of cane sugar 95 per cent. of the total imports of sugar, whereas in 1889, through the direct operation of the bounty system, the imports of beet sugar were 65 per cent. and of cane sugar 35 per cent. of the total imports of sugar. The increasing substitution by this protection is the interference with the natural course of production of beet sugar for cane sugar, as disadvantageous to our sugar consumers, and injurious to the productive interests of the United Kingdom and her Majesty's colonies. The labour interests of the United Kingdom and British colonies are most injuriously affected by this substitution of beet for cane sugar, inasmuch as the cane sugar production affords infinately more employment for British labour than does that of beet sugar. In short the substitution of beet for cane sugar is in fact the substitution of continental labour

for that of this country, and her Majesty's colonies. Your memorialists beg leave to remind her Majesty's present Government that it has been the open and avowed policy of her Majesty's Administrations of both parties for many years past to terminate the system of export bounties; and in a communication some few years ago from Mr. Gladstone, that statesman had no hesitation in saying that it was the "duty of her Majesty's Government to take the initiative in this matter as involving greatly the interests both of revenue and of trade." Your memorialists have observed with much regret the most unnecessary rise of a fictitious and factious opposition to the convention, but they venture to hope that her Majesty's Government will not be deterred by such a mere party opposition, but should, in reliance upon the merits of the convention as a measure of sound commercial policy, proceed forthwith with the necessary measures to bring it into operation.

Sir JAMES FERGUSSON stated that Lord Salisbury had desired him to receive the deputation. Although his lordship was quite recovered and able to meet Parliament, still it was very desirable that Lord Salisbury should not in the present weather be exposed more than could be helped. He (Sir James) would be happy to hear what the deputation had to say, and would communicate with the Prime Minister.

The deputation recapitulated the facts as to the decline of the sugar industry in this country, owing to the effect of foreign sugar bounties, and it was pointed out that many other dependent trades had suffered equally with that of the refiners. For instance, dock coopering in the case of sugar had absolutely died out, although nine years ago the industry gave employment to many thousand workmen. It was due to the British labourer thus affected that the Government should press the Bill for the abolition of bounties, and the deputation hoped that the measure would be re-introduced early in the coming session, and that a division would be taken upon it in the House of Commons.

Sir JAMES FERGUSSON in reply, said: I have stated that I was deputed to receive you on behalf of the Prime Minister, and the presence of reporters will show you that there is every desire that the statements you have to make shall be brought before her Majesty's Government with the utmost completeness. It would, however, be of no use at all for me to express my individual opinion upon any of the statements so forcibly put forward just now; but it is my duty to

report what you have said, and to take care that your statements are fully made known to her Majesty's Government. You will recognise that it is not usual, and it would be most inconvenient, that any statement should be made so near the meeting of Parliament as to the intentions of the Government with regard to any particular measure. That you know has not been done in any case; but it is certainly very desirable that those who take a deep interest in the progress of any measure should have every opportunity of making their statements and opinions known. I think you will see that the course which has been taken is most calculated to promote that object, and you may be sure that nothing you have said to-day will fail to be represented.

The deputation thanked Sir James for the interview, and informed him that last year some of their number waited upon M. Tirard, and satisfied themselves, from the French Prime Minister's reply, that there was no chance of France abandoning sugar bounties until England herself had taken firm action in the matter.

THE YIELD OF JUICE FROM A TON OF CANE.

The Louisiana Planter, in answer to the question:—"What is the maximum yield of juice from a ton of cane, and what amount of juice does it take to make five pounds of first and second sugar?"—gives the following answer:—

A first rate single mill can extract 60 per cent. of juice from average cane; say 1,200 pounds or 137 gallons of $8\frac{3}{4}$ pounds each. A good double mill will extract 70 per cent., or 1,400 pounds, or 160 gallons of juice. A first class double mill, with saturation between the mills, will extract 75 per cent. of juice, or 1,500 pounds per ton, or 171 gallons.

These three grades of mills give us, then, respectively, 137 gallons, 160 gallons, and 171 gallons of juice. This juice commonly makes three-fourths of a pound of sugar of all kinds to the gallon; it frequently makes seven-eighths of a pound to the gallon, and should make one pound of sugar to the gallon every time.

GERMAN OPINION OF THE FRENCH AND OTHER BOUNTIES.

According to the *Deutsche Zuckerindustrie*, the question of the high sugar bounties in France, and their influence on the prices of German sugars was discussed at the last sitting of the Halberstadt Union of Sugar Manufacturers. Statistical information produced abundantly proved that very considerable injury was inflicted on the German sugar industry by means of the high bounties on export which was granted most especially in France, amounting to M. 8.57 per metric centner against M. 2.25 in Germany, *i.e.*, M. 6.32 more. This is equivalent to 4s. 2d. per cwt. in France against 1s. 1d. in Germany, a difference of 3s. 1d. In consequence of this the production in France is increasing at a rate such as Germany cannot possibly show; and a further increase is looked for next few years as a result of the high premiums. With this great increase in production the exports will also increase considerably. The same state of things is met with in Belgium. These facts, which are not properly known among those most interested, must be laid before them, and it must be clearly pointed out what a great amount of injury is being done to the German industry by these excessively high premiums.

We may observe that the production in France for 1889-90, now estimated at 1,250,000 tons, against 990,600 tons in 1888-89, and in Belgium at 200,000 tons, against 145,800 tons in 1888-89, an increase of 259,400 and 54,200 tons respectively.

THE BOUNTY ON SUGAR IN BELGIUM.

Mr. Goerz, of Berlin, has asserted, in his *Telegraphische Correspondenz*, that the premium gained by the Belgium sugar manufacturers under the existing law of 1889, amounts to 10fcs. 46c., on every 100 kilos. of the actual production. This is equal to 4s. 3d. per cwt. Mr. François Sachs, of Gembloux, contests the whole of Mr. Goerz's calculations, and declares that the maximum premium is 3fcs. 73c., equal to 1s. 6d. per cwt.

The statements of Mr. Goerz, and also those of Mr. Licht, in his weekly report, were published in the French *Sucrerie Indigène*, and have elicited the following rejoinder from the Executive Council of the Association of Sugar Manufacturers in Belgium :—

(Translation.)

Brussels, February 14th, 1890.

To the Editor,

Under the title of "The Premium in Belgium," you publish in the *Sucrerie Indigène* of the 4th February, an article by Mr. Goerz, proving that on every sack of sugar produced in Belgium there is a premium of 10frs. 46c.

In your number of the 11th February, under the title of "The Excédents on the Yield in Belgium," you publish an extract from Mr. Licht's Weekly Report, proving that in the campaign of 1888-89, the actual production has exceeded by 50,000,000 kilos. (50,000 tons) the production resulting from the official *prises en charges*. This reached about 96,000,000 kilos. (96,000 tons).

The total premium, therefore, at the rate of 15frs., amounted to 22,500,000frs., *i.e.*, a premium of about 15frs. 50c. for each sack of the 1,400,000 sacks produced.

As there is no more reason for suspecting the good faith of Mr. Licht than that of Mr. Goerz, we shall assume the truth to lie half-way between the two, and will fix the Belgian premium at 13frs.

The French manufacturers, and you yourself assert that the French premium does not exceed 7 to 8 frs.

The German manufacturers, with Mr. Licht and Mr. Goerz, declare that their premium is only 3frs. 30c.

In addition, each of the three countries levies a surtax of from 7 to 8frs. per sack on sugar entering the country.

It must be allowed that under such conditions neither you nor the Germans can carry on the contest; whilst the French and German production only increased to a slight extent last campaign, the Belgian production has doubled.

Being by far the most favoured by Government of the three, we think it is for us to make the first advance, and we therefore offer to you and also to the German manufacturers, a radical solution of the sugar question.

We propose: 1. The abolition in common of the surtaxes.

2. As regards Belgium, the total suppression of the premiums, by the abolition of all taxes on sugar.

3. As regards Germany, the same measure as for Belgium, the suppression of the duty. The Government will find no difficulty in

recouping themselves in another quarter for the 50 millions produced by sugar.

4. Finally, as regards France, the levying of a reduced duty of 25frs. Sugar brought in last year 150 millions to the Government, and as you consumed about 500,000,000 kilos. (500,000 tons), at 25frs., the new receipts would still be 125 millions. It would not be very difficult for the Government, in face of the results obtained, to replace the missing 25 millions.

The combination which we propose possesses every advantage for her, without taking into account the enormous development of consumption which would take place in Europe.

We are sure that you will be completely in accord with us. France, Germany, and Belgium all being agreed, we should propose to you the holding of a Sugar Congress at Brussels, to which shall be invited the manufacturers of all the sugar producing countries of Europe.

We hope you will have the goodness to publish this communication in your next number, and remain, &c.,

Le Conseil d'Administration de la Société générale des fabricants de sucre de Belgique:

ALBERT PUISSANT, Président;
EUGENE MEEUS ET HENRI SIMON, Vice-Présidents;
J. RENARD, Secrétaire;
H. CARTUYVELS, MAX LE DOCTE, EDM. LOSSEAU, MOMMENS, STEVENART et VICTOR VAN VOLSEM, Membres.

On this, M. Tardieu, the editor of the *Sucrerie Indigène*, remarks: The above proposition is a bold one, but our esteemed correspondents will certainly suspect that we are not, especially at the present moment, in a position to take up the gage which they throw down to us.

DIFFUSION IN CUBA.

According to the *Diario de la Marina*, the estate of San Joaquin, belonging to the Conde de Ibanez, has recently set up a diffusion apparatus, which is working admirably, and augurs a complete revolution in the system of manufacturing sugar there. Another diffusion apparatus, lately erected on the Montana Estate, the property of the same gentleman, will also shortly commence working.

ON THE WORKING OF A CANE-SUGAR CENTRAL FACTORY AND DISTILLERY.

BY GEO. STADE (Charlottenburg 2, Berlin).

It is an undeniable fact that during the past few years the manufacture of cane sugar has tended more and more to abandon the old worn-out paths. Amongst other processes that of Diffusion, now crowned with complete success, (see the author's treatises, the *Sugar Cane* of 1886-87, &c.,) has, through the exertions of American and European technical experts, lent a special impulse to the introduction of new and more rational methods of working into those countries which produce colonial sugar, with a view of increasing the yield of sugar and diminishing the cost of production, so as to be able, even with a return of the prices prevailing in 1884, to work to a profit.

Although, however, in the nature of things, progress only makes its way very slowly in countries and among people who, with an innate tendency to conservatism, are often removed by several thousand miles from the central point of so-called culture, yet in cannot be denied that improvements have been definitely effected too many plantations and will go on further extending.

In many cases the planter-manufacturer has been exceedingly cautious in adopting the troublesome innovations, as he had already too often been bitterly disappointed and deceived by advertising firms, and compelled to pay dearly for his experiments. This has mostly been the case where the attempt had been made to transfer the manufacturing processes used for beet sugar (I will here only mention osmose and such like methods,) directly to cane sugar factories, ignoring the radical differences in the composition of the two juices both in the raw state and under other circumstances. Considering the important changes introduced into the beet sugar factories, and above all looking to the really splendid results of modern beet cultivation (the latest reports talk of 20 per cent. of saccharose in the beets grown for seed) the often quoted remark of the great Justus von Liebig—"beet sugar presents no prospect of success and has no future," is, taking into account the high intelligence of those connected with the manufacture of sugar, neither being fulfilled at present, nor

likely to be in the time of abolition of all so-called premiums, to which we may confidently look forward. Yet in spite of this the superiority of the cane over the beet remains as firmly established as ever. And this superiority is to be looked for, not, as is for the most part wrongly believed, either in the high saccharine content of the cane which is now and then met with, nor in the great purity of the juice, nor even in the exceedingly easy manipulation of the cane in normal states of the weather, but solely and entirely in the results of the agricultural operations, in the natural yield.

European beet cultivators are still far from obtaining such results as have actually been attained (certainly in this case only locally); crops of 125,000 kilos. of cane per hectare or 625 centner per morgen, equal to 50 tons per acre, and even more than this. But the fact that such results can indeed be attained with good soil, regular irrigation and sensible and reasonable manuring, indicates a degree of productiveness of the tropical soil through solar influences, to reach which would be a hard task both for beet cultivators and science itself.

In his articles on Guadeloupe in the *Sucrerie Indigène* of 1882, &c., Mr. E. Riffard speaks of yields of 100 tons per hectare (40 tons per acre). In his detailed publication, "Culture de la Canne à la Guadeloupe in 1887," Mr. P. Boname gives the following as average crops for that island:—

First Planting	....	60 to 75 tons per hectare.
Second ,,	....	30 to 40 ,, ,,

In his manual, "La Canne à Sucre" (Paris, 1884), Mr. A. Delteil mentions 75 to 80 tons per hectare under normal circumstances, &c.

Finally, the very interesting experiments with various kinds of canes, lately conducted by Professor Harrison, in Barbados, not unfrequently indicate a yield of 80 to 90 tons per hectare.

Sugar plantations may, if desirable, be divided into three different classes, according to the method adopted in manufacture, but it may be mentioned that this classification, though certainly optional, is yet a very convenient one, which corresponds with their position as regards productivity and rational manner of working.

Class I.

The operations of the factories belonging to this class are as a rule only on a small scale. The mode of cultivation is in principle the same as that in use on larger plantations, at any rate not much inferior. The transport is effected by animal labour, here and there

by agricultural railways or canal, where available. The cane is supplied to the mill by hand or by small elevators. The work is carried on only by day; the boiling is done entirely over the open fire or in open vessels. The product is the ordinary muscovado or jaggery. This is either rammed in the form of masse-cuite into casks, in which holes are bored for running off the molasses, or the masse-cuite is oscillated or centrifugalled direct. The latter is the more uncommon method. There is, as a rule, no boiling for second product, but the syrup is sold, only rarely distilled. There is little or no weighing done in this kind of establishments, the number of acres cut is known, and the barrels are counted. The laboratory consists at the most of an isolated Beaumé hydrometer. This suffices for them. Antiquated arrangements will exist as long as the *saccharum officinarum* forms sugar. The entire class is certainly in process of dying out in this age of steam machinery, but in spite of everything it dies very hard. Size of these establishments:—Land cultivated, 250 to 750 acres; yield of sugar obtained from the cane, 5 to 8 per cent.; saccharine content of the only product, 75 to 95, according to the manipulation.

CLASS II.

The works belonging to this class possess several modern appliances. The same remarks apply with respect to the agricultural process as those already made. Open ditches carry off the water, but other systems of drainage are also met with. The transport is the same as in Class I., but there are also railways of wider gauge. The emptying of the waggons is effected entirely by the cane-carrier. Now and then the cane or the bagasse is weighed, or at any rate calculated, and in several cases the juice is also tested by polariscope, and, where they are tolerably advanced, an attempt (certainly in the most primitive fashion) is made to estimate the quantity of glucose. There are also, here and there, two mills for better extraction of the juice. Work is carried on as a rule from early in the morning till late in the evening, and then everything is left standing till next morning. The motive power is steam; boiling in open kettles, whether by direct application of fire or with steam, is still met with. Here and there a small triple effect is used. On the other hand, it is usual to finish boiling in vacuo, whether the sugar is for direct consumption or for the refinery. The product is a good, dry, crystallised sugar. The molasses are also boiled and centrifugalled. The residual molasses are distilled, not often sold.

There are some attempts at regular registration of the operations, and this kind of factories forms a transition to the work in central factories. Size of these establishments:—

Land cultivated	from 750 to 1750 acres.	
Yield of sugar obtained from the cane	7, 8, or 9%.	
Saccharine content of the 1st product	94 to 99%	very variable according to the mode of working.
Ditto ditto 2nd product.	80 to 90%	

CLASS III.

In this case everything is calculated for larger operations. Rails or canals intersect the district. In many cases steam ploughing is used, and tile-drainage is being more and more introduced. The management of the cultivation and the factory is usually separate, and the factory in certain cases even buys cane independently for crushing. The work is carried on uninterruptedly. On Saturday the boiling is stopped. The mills are of the largest size, and the most various systems of extraction are employed, such as:—

1. Large three-roller mills.
2. Five or more roller mills.
3. Slicing or previous crushing of the cane, followed by more complete crushing.

Finally the modern *enfant terrible* of the cane sugar manufacture, Diffusion.

The juice (after defecation) is on the whole treated in a manner similar to that in use in the beet factories. They are not content with two products, but are beginning third and fourth boilings. The molasses remaining are naturally of little value, and hence are in many cases distilled.

The size of the establishment varies exceedingly, the following figures may be taken as approximate:—

Land cultivated	from 1,750 to 5,000 acres.
Cane worked up per day	,, 250 to 1,000 tons.
Yield of sugar of all kinds (without diffusion) ..	8 to 11 per cent.
Saccharine content as in Class II.	

The following data are obtained from a plantation of this last class. As it may be assumed that both the mode of cultivation and of manufacture of the sugar cane are universally known to those interested, only slight indications are given of the manner in which the operations of the plantation were carried on.

A.—The Manufacture of Sugar.

I. *Agriculture.*

The whole of the working is under one general manager, and consists in the direction of several outlying works (so called plantations without sugar making). Each of these addenda has its own personnel, independent book-keeping, and its own material, hospital, and workmen's dwellings.

There are over 3750 acres of land under cultivation, and of these from 165 to 250 acres are cut annually. New plantings are made by means of cane-tops, and the percentage of plant-cane on the total crop is from 50 to 60. It is not advisable to allow the ratoons to stand longer than three years, as in that case the yield (about 8 tons per acre) decreases too much, and no longer covers the cost of production.

The cultivation is effected by manual labour (on account of local circumstances); open drains take off the water from the soil. The general average yield in cane amounts in this case to about 20 tons per acre.

Very little manuring is done, the manures are superphosphate, and, most usually, sulphate of ammonia.

The following table shows the cost of production as regards the agricultural operations, details of every operation being given :—

TABLE I.

Calculation of Cost of Agriculture.

	Cost per Acre.		Cost per Ton of Cane.		Cost per Cwt. of Cane.	Cost per Ton of Sugar.	
I. Management.	$	s.	$	s.	s.	$	s.
Direction	4·18	17·39	0·21	0·85	0·043	2·05	8·53
Oversight	2·90	12·06	0·14	0·59	0·030	1·42	5·91
Servants	0·62	2·58	0·03	0·13	0·006	0·30	1·25
II. Operations.							
Fresh planting..........	3·13	13·02	0·15	0·64	0·032	1·53	6·37
Supplying ratoons	1·48	6·16	0·07	0·30	0·015	0·72	3·00
Weeding (fresh planting).	5·20	21·63	0·26	1·06	0·053	2·55	10·61
Do. (old plants)	4·33	18·01	0·21	0·88	0·044	2·12	8·82
Manuring.............	0·94	3·91	0·05	0·19	0·010	0·46	1·91
Ploughing	2·66	11·07	0·13	0·54	0·027	1·30	5·41
Drilling	0·83	3·45	0·04	0·17	0·009	0·41	1·71
Draining	2·30	9·57	0·11	0·47	0·024	1·13	4·70
Stripping	0·58	2·41	0·03	0·12	0·006	0·28	1·17
Cutting................	2·15	8·94	0·11	0·44	0·022	1·05	4·37
Loading	2·26	9·40	0·11	0·46	0·023	1·11	4·62
Watching..............	0·19	0·79	0·01	0·04	0·002	0·09	0·37
III. Materials.							
Manure................	4·33	18·01	0·21	0·88	0·044	2·12	8·82
Implements	0·70	2·91	0·03	0·14	0·007	0·34	1·41
IV. Maintenance.							
Immigration	1·73	7·20	0·09	0·35	0·018	0·85	3·54
Hospital	1·64	6·82	0·08	0·33	0·017	0·80	3·33
Taxes, Insurance	2·34	9·73	0·12	0·48	0·024	1·15	4·78

II. *Transport of the Cane.*

This is effected by two-wheeled mule-carts which deliver the cane to the individual loading stations. About 60 miles of wide guage rails intersect the land, and 100 waggons of 6 tons load, drawn by 6 or 7 locomotives, weighing 10 to 12 tons, and of 50 tons draught power, convey the cane to the mills. Every waggon is weighed by the appointed employé before it is emptied into the elevators. No deduction is made for leaves, which frequently render the working of the mills much more difficult.

An extensive repairing workshop is in operation all the year.

TABLE II.

CALCULATION OF THE GENERAL COST OF CONVEYANCE OF THE CANE.

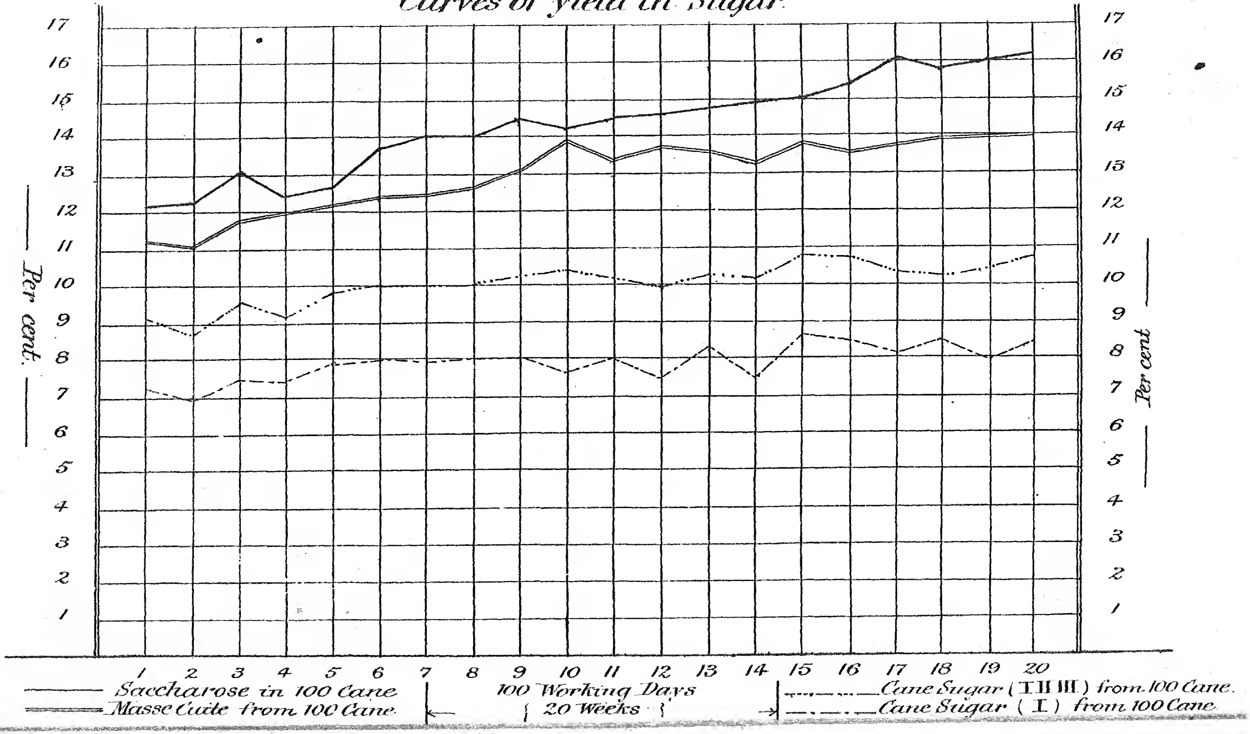
	Cost per Acre.		Cost per Ton of Cane.		Cost per Cwt. of Cane.	Cost per Ton of Sugar.	
	$	s.	$	s.	s.	$	s.
I. MANAGEMENT	0·37	1·54	0·02	0·08	0·004	0·18	0·75
II. WAGES, &c.							
Labour	3·21	13·35	0·16	0·65	0·033	1·57	6·53
Maintenance of Wagons, Horses, &c.	2·31	9·19	0·11	0·47	0·024	1·13	4·70
Maintenance of Lines, Roads, &c.	2·59	10·77	0·13	0·52	0·026	1·26	5·24
III. COAL AND FODDER.	3·97	16·51	0·20	0·81	0·046	1·95	8·11
IV. MATERIALS.							
Wagons, Horses, &c. ..	4·57	19·01	0·22	0·93	0·046	2·23	9·28
Lines, Roads, &c.	1·31	5·45	0·06	0·27	0·013	0·64	2·60
V. TAXES	0·94	3·91	0·05	0·20	0·010	0·47	1·96

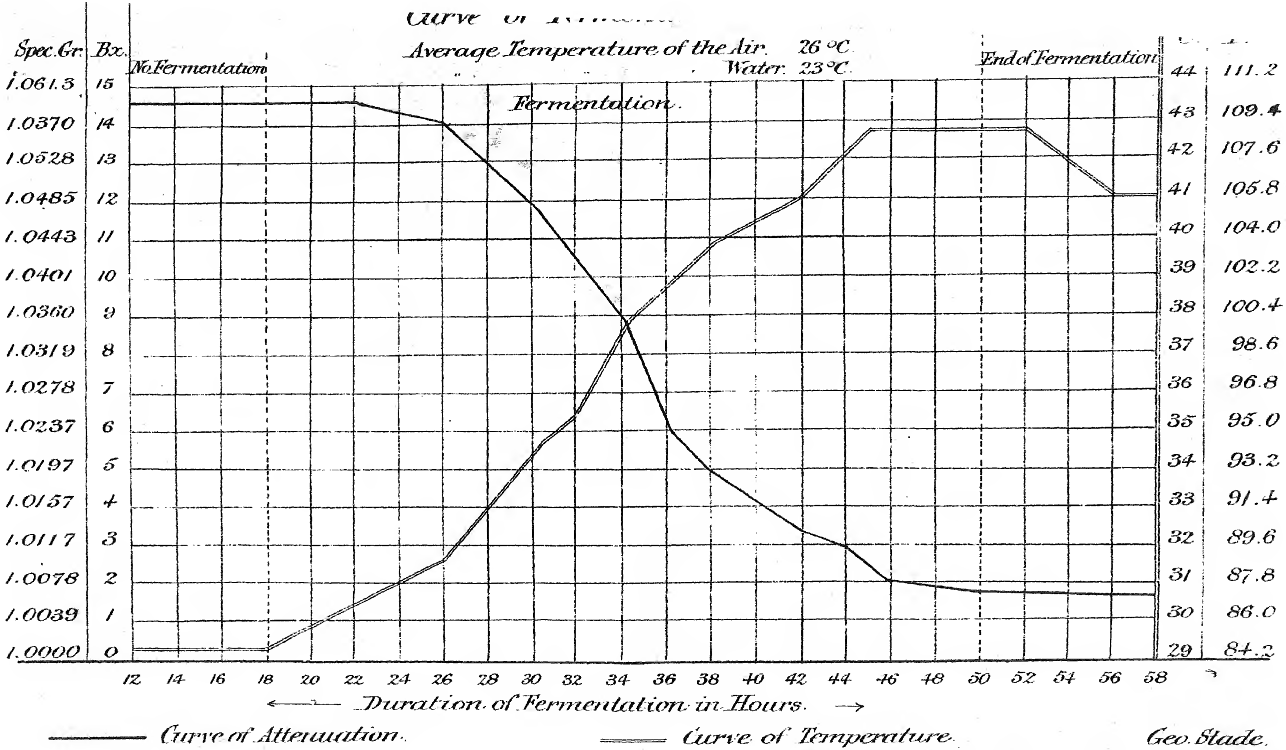
The preceding figures will give an idea of the expense of keeping up this department. The amount of sugar, cane, materials, &c., conveyed is about 150,000 tons per annum.

III. *Central Factory.*

The cane here undergoes a single crushing in excellently constructed mills of large calibre. The juice, after being strained, is heated in three heaters to boiling point, partly by exhaust steam, and partly by direct steam, and is then defecated with lime, until the acidity present is only small. The clarified liquid runs direct to the triple-

Curves of yield in Sugar.





Average Temperature of the Air. 26 °C
Water. 23 °C
No Fermentation
Fermentation.
End of Fermentation
Spec. Gr.
Bx.
1.0613 15
1.0370 14
1.0528 13
1.0485 12
1.0443 11
1.0401 10
1.0360 9
1.0319 8
1.0278 7
1.0237 6
1.0197 5
1.0157 4
1.0117 3
1.0078 2
1.0039 1
1.0000 0
44 111.2
43 109.4
42 107.6
41 105.8
40 104.0
39 102.2
38 100.4
37 98.6
36 96.8
35 95.0
34 93.2
33 91.4
32 89.6
31 87.8
30 86.0
29 84.2
12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58
← Duration of Fermentation in Hours. →
Curve of Attenuation.
Curve of Temperature.
Geo. Stade.

effect, and the scum which remains over is filtered as far as possible in filter presses. Several vacuum pans are used for boiling, which is conducted under a pressure of about 1 atmosphere (15lbs.). The masse-cuite is centrifugalled while warm, and the sugar is sent off daily to the quay belonging to the factory. The second product is allowed to stand from 10 to 15 days, the third (and last) product is worked over after the close of the season. Half of the production is turned out as grocers' sugar, chloride of tin being used, the other half being dark refining sugar.

Ten to sixteen boilers with over 1,000 sq. metres heating surface supply the necessary steam for about 20 engines. The fuel is coal and bagasse, either mixed or alone, as required.

The boilers are tubular and compound (fire tubes and tubular boilers arranged one behind the other).

The average consumption of fuel per campaign is about six of coal per cent. of cane.*

The factory employs about 150 workmen, who live on the works in the plantations or in the village.

The data next following will serve to give an idea of the amount and quality of the work. It may be further remarked that the whole establishment belongs technically to the better of the kind, and in times past was even regarded as a pattern factory.

The Masses-cuites I. and II. were weighed; No. III. was estimated, *i.e.*, measured.

The quantity worked up at the factory amounts per crop to about 60,000 to 70,000 tons of cane, according to the yield in the field; from this about 66 per cent. of the juice is obtained by single crushing.

The following results of the actual working in one campaign may be considered as practically exact. (See also Diagram No. 1):—

One hundred tons of cane gave—

I. MASSE-CUITE.

12·978	tons	No. I.				
4·610	,,	,, II.=	35·51%	of masse-cuite	No.	I.
2·810	,,	,, III.=	26·67%	,,	,,	I.
		or	61·01%	,,	,,	II.

* See in this connection also the author's comparative tables, relating to fuel with diffusion and with the mill. "Note on Coal Consumption" (*Sugar Cane*, 1886, p. 468), where 0·6 ton of coal per ton of sugar is assumed. From this it results that the coal consumption with the mill is 5·70 tons per 100 tons of cane, and with diffusion (without bagass) 15 tons per 100 tons of cane, while the results, with successful use of bagasse, according to the latest information received (*Sugar Cane*, 1889, page 355,) are given as 11·21 tons for British Guiana. But we hear even of only about 2 tons (?) being used in the Sandwich Islands!

II. SUGAR.

7·852 tons sugar No. I.	= 60·50%	of masse-cuite No.	I.
1·524 ,, ,, ,, II.	= 11·77%	,, ,,	I.
	or 33·16%	,, ,,	II.
0·672 ,, ,, ,, III.	= 5·18%	,, ,,	I.
	or 23·90%	,, ,,	III.

The total yield being 10·048 tons of sugar (I., II., and III.) = 77·45% of masse-cuite No. I.

III. MOLASSES.

2·139 tons of molasses left over = 16·49% of masse-cuite No. I.

The yield in chemically pure sugar is tolerably exactly established in the figures given below. As regards the analysis of the cane, it must be noted that the saccharine content ($C_{12}H_{22}O_{11}$) was mostly obtained by the direct method. For this purpose a specially constructed apparatus was employed, the mode of working being that of the new extraction vessels of Professor Scheibler, and the vessel for receiving the chopped up cane slices being of platina, which was hung free in the steam chamber. The cane, duly weighed and exhausted by absolute alcohol, was used also for the approximate determination of the cellulose and ashes, &c.

The absolute content in juice in the campaign in question was:—

Average	88 per cent.
Maximum	93 ,,
Minimum	85 ,,

It varied regularly, and altered only in the case of cane of an abnormal character.

The average content is partially indicated in the following calculations. The amount of glucose or invert sugar has been left out of the calculation and no figures for this are here given.

		Percentage Calculated on the Weight of Cane.
1.	Saccharose	14·220 ($C_{12}H_{22}O_{11}$)
2.	Saccharose obtained in the juice	11·016 ,,
3.	Loss in the bagasse	3·204 ,,
4.	Saccharose obtained in form of sugar (I., II., III.)	9·435 ,,
5.	Difference between Nos. 2 and 4 ..	1·581 ,,
6.	Obtained in molasses (approximatively)	0·540 ,,
7.	Loss by inversion and in the working (not including bagasse)	1·041 ,,

8. Total loss in manufacture:—
   - (*a*) Loss in the bagasse.
   - (*b*) Loss in working (scum, &c.)
   - (*c*) Loss by inversion during working.
   - (*d*) Loss in the molasses:—
     - (A) Saccharose.
     - (B) Saccharose inverted but not lost (invert sugar).

Total loss on the yield:—

4·785 per cent. of $C_{12}H_{22}O_{11}$ on weight of cane.

TABLE III.*

DETAILED CALCULATION OF THE GENERAL EXPENSES IN THE CENTRAL FACTORY.

	Expenses per						
	Acre.		Ton of Cane.		Cwt. Cane.	Ton of Sugar.	
I. MANAGEMENT.	$	s.	$	s.	s.	$	s.
1. Direction	2·09	8·69	0·10	0·42	0·021	1·02	4·24
2. Oversight	1·30	5·41	0·06	0·27	0·013	0·64	2·66
3. Servants, &c.	0·26	1·08	0·01	0·05	0·002	0·12	0·50
II. WAGES.							
(a) *While Working.*							
1. Cane Carrier..	0·80	3·32	0·04	0·16	0·008	0·39	1·62
2. Extraction of juice ..	0·83	3·45	0·04	0·17	0·009	0·41	1·71
3. Defecation of juice ..	0·80	3·32	0·04	0·16	0·008	0·39	1·62
4. Boiling	0·36	1·50	0·02	0·08	0·004	0·18	0·75
5. Centrifugalling	0·90	3·47	0·04	0·18	0·009	0·44	1·83
6. Packing and loading .	0·27	1·12	0·01	0·05	0·003	0·13	0·54
7. Coal boiler-house	0·84	3·49	0·04	0·17	0·009	0·41	1·71
8. Bagasse ditto	0·33	1·37	0·02	0·07	0·003	0·16	0·67
9. Lighting & watchmen	0·59	2·45	0·03	0·12	0·006	0·29	1·21
10. Engineering	0·64	2·66	0·03	0·13	0·006	0·31	1·29
11. Sundries..	0·42	1·75	0·02	0·09	0·004	0·21	0·87
(b) *While Standing.*							
1. Engineers, &c... ..	0·77	3·20	0·04	0·16	0·008	0·38	1·58
2. Bricklayers, Carpenters, &c.	1·01	4·20	0·05	0·20	0·010	0·49	2·04
III. CARRIAGE.							
1. Conveyance to wharf.	0·11	0·46	0·01	0·03	0·001	0·06	0·25
2. Warehousing and unloading	0·30	1·25	0·01	0·06	0·003	0·14	0·58
3. Watchmen	0·30	1·25	0·01	0·06	0·003	0·14	0·58
4. Shipment on Steamer	2·04	8·49	0·10	0·42	0·028	1·00	4·16
IV. MATERIALS.							
1. General	1·33	5·54	0·07	0·27	0·013	0·65	2·70
2. Lubricating oil, &c..	0·40	1·66	0·02	0·08	0·004	0·20	0·83
3. Acids and lime	1·28	5·33	0·06	0·26	0·013	0·63	2·62
4. Lighting material ..	0·08	0·33	0·01	0·02	0·001	0·04	0·17
5. Filtering do. ..	0·30	1·25	0·01	0·06	0·003	0·14	0·58
6. Packing do. ..	2·20	9·15	0·11	0·45	0·023	1·08	4·49
7. Spare machinery	2·43	10·11	0·12	0·49	0·025	1·19	4·89
V. FUEL.							
1. Coal	1·89	7·86	0·09	0·38	0·019	0·92	3·83
2. Freight	2·57	10·69	0·13	0·52	0·026	1·26	5·24
3. Unloading..	0·29	1·21	0·01	0·06	0·003	0·14	0·58
VI. MAINTENANCE.							
1. Insurance	0·32	1·33	0·02	0·07	0·003	0·16	0·67
2. Taxes and duty	2·22	9·24	0·11	0·45	0·023	1·09	4·53
3. Immigration	0·23	0·96	0·01	0·05	0·002	0·11	0·46
4. Sundries, repairs, &c.	1·43	5·95	0·07	0·29	0·015	0·70	2·91
5. Infirmary	0·30	1·25	0·01	0·06	0·003	0·14	0·58
VII. FREIGHT OF SUGAR	15·22	63·32	0·75	3·10	0·155	7·46	31·03
VIII. COMMISSION	7·61	31·66	0·37	1·55	0·076	3·73	15·52

* It may be observed that no account is taken in the tables of deduction for depreciation on machinery, interest, &c. It is therefore not possible to compare these tables quite exactly with the corresponding tables for working in Europe. Repairs and new machinery, for example, are summed up under "spare machinery."

It is quite clear that that portion of the saccharose in the cane which is inverted in the working, and passes into the molasses, being, as far as sugar making is concerned, lost,—must be booked as a loss to the central factory. This loss naturally appears as a gain to the distillery, and so is at any rate not an absolute pecuniary deficit.

Unfortunately in the factory in question there was a total want of means of detailing the special loss in working, and in the same manner the not ascertainable but mostly imaginary losses could not be distinctly indicated.

As stated above, the yield in saccharose in the form of raw sugar was 9·435 per cent., and hence out of every 100 parts (by weight) of cane brought into the factory there were **66·351** parts of saccharose sent out again in the form of raw sugar.

The yield obtained on the raw juice was:—**85·55** per cent. of $C_{12} H_{22} O_{11}$ in the form of raw sugar. This must be regarded as by no means unsatisfactory, taking into consideration the circumstances and the arrangements of machinery, &c.

Total Expense of Working.

The whole of the principal items of the three departments are brought together in the following table.

TABLE IV.

	Expenditure per						
	Acre.		Ton of Cane.		Cwt. of Cane.	Ton of Sugar.	
I. Agricultural Dept.	$	s.	$	s.	s.	$	s.
1. Management	7·704	32·049	0·377	1·570	0·079	3·772	15·700
2. Cultivation	26·059	108·405	1·276	5·307	0·265	12·758	53·073
3. Materials	5·041	20·971	0·247	1·027	0·051	2·468	10·267
4. Maintenance	5·713	23·766	0·280	1·164	0·058	2·797	11·635
II. Carriage of Cane.							
1. Management	0·371	1·543	0·018	0·076	0·004	0·182	0·757
2. Wages	8·100	33·696	0·399	1·662	0·083	3·995	16·619
3. Coal, Fodder	3·971	16·519	0·195	0·810	0·040	1·946	8·095
4. Materials	5·888	24·494	0·288	1·200	0·060	2·884	11·997
5. Taxes	0·971	4·039	0·048	0·198	0·010	0·476	1·980
III. Central Factory.							
1. Management	3·651	15·188	0·179	0·744	0·037	1·789	7·442
2. Wages	8·563	35·622	0·420	1·745	0·087	4·195	17·451
3. Carriage	2·749	11·436	0·135	0·560	0·028	1·347	5·603
4. Materials	8·040	33·446	0·394	1·639	0·082	3·939	16·386
5. Fuel	4·748	19·752	0·233	0·968	0·048	2·326	9·676
6. Maintenance	4·506	18·745	0·221	0·919	0·046	2·208	9·185
7. Freight of Sugar	15·224	63·332	0·746	3·103	0·155	7·458	31·025
8. Commission	7·612	31·666	0·373	1·551	0·078	3·729	15·513

TABLE V.

GENERAL EXPENDITURE FOR AGRICULTURAL OPERATIONS, CONVEYANCE OF CANE, AND CENTRAL FACTORY.

	General Cost per						
	Acre.		Ton of Cane.		Cwt. of Cane.	Ton of Sugar.	
	$	s.	$	s.	s.	$	s.
(a) A. Agriculture	44·52	185·20	2·18	9·07	0·45	21·80	90·69
B. Conveyance	19·30	80·29	0·95	3·94	0·20	9·46	39·35
C. Central Factory ..	55·09	229·17	2·70	11·23	0·56	26·99	112·28
(b) A. & B., Agriculture and Conveyance ..	63·82	265·49	3·13	13·01	0·65	31·26	130·04
C. Central Factory ..	55·09	229·17	2·70	11·23	0·56	26·99	112·28
(c) Cost of Production ..	118·91	494·66	5·82	24·23	1·21	58·24	242·28
Deduct Molasses.. ..	6·55	27·25	0·32	1·34	0·07	3·21	13·35
Net Expenditure of the Sugar Manufacture..	112·36	467·41	5·50	22·89	1·14	55·03	228·93

B. DISTILLERY.

It now only remains to cast a short glance over the conversion of the molasses into alcohol, which in the colonial raw sugar manufacture tolerably nearly supplies, or should supply the place of the various processes for the extraction of sugar from molasses in the European factories.

The distillery worked up yearly from 1,000 to 2,000 tons of molasses, mostly, in comparison with the usual run in that locality, of very poor quality.

The wash was put up (in vats of 50 cubic metres content) at 1·060 specific gravity = 14·7° Balling. The fermentation took place quickly, without cooling, and without any particular difficulties, or any special addition of any ferment. The residue was partly used for manure and the remainder was allowed to flow as waste into the sea.

From 100 litres of wash were obtained 6 to 7 litres of alcohol of 80 per cent. Tralles (40 over proof) which is equal to 40 or 50 litres of rum from 100 litres of molasses.

Average analysis of the molasses worked up, all the sugar being indicated as glucose:—52·60 per cent. $C_6H_{12}O_6$.

I append some average figures as regards yield obtained, which will not be without interest for specialists.

	Per cent.	Theoretical Yield.
1. Loss of alcohol (C_2H_5OH) unfermented sugar	2·201	100 Kilos. Dextrose. = 51·11 Kilos. Ethyl-Alcohol.
2. ,, ,, ,, in fermentation .. (difference)	19·067	
3. ,, ,, ,, in distillation and rectification....	5·182	
4. Total loss of alcohol ,, ...	26·450	
5. Total yield obtained	73·350	

Highest percentage on the theoretical yield .... 80·29
Lowest ,, ,, ,, ... 62·68

In his hand-book for the manufacture of spirits, Prof. Maercker gives the following figures for starch flour:—

With good working ....85·1 per cent. of theoretical yield.
,, medium ,, ...76·7 ,, ,, ,, ,,
,, bad ,, ...67·2 ,, ,, ,, ,,

From this it follows that, considering the temperature and method of working, the yield of spirit also obtained cannot be regarded as bad. The following figures give an idea of the total cost of the distillery, analogous to that already given for the working of the Central Factory:—

TABLE VI.

GENERAL COST OF WORKING THE DISTILLERY.

	Total Expenditure per							
	Ton of Cane.		Ton of Molasses.		Ton of Spirits of 80°/o Tralles.		100 Imp. Gallons.	
							Molasses	Rum.
	$	s.	$	s.	$	s.	$	s.
1. Molasses..	0·32	1·33	15·00	62·40	54·66	227·40	9·44	21·46
2. Management ..	0·02	0·08	0·94	3·91	3·42	14·23	0·50	1·35
3. Coal..	0·07	0·29	3·18	13·23	11·58	48·17	2·00	4·55
4. Materials	0·03	0·13	1·52	6·32	5·27	21·92	0·96	2·17
5. Casks	0·07	0·29	3·33	13·85	12·13	50·46	2·09	4·76
6. Carriage, &c. ..	0·01	0·04	0·67	2·79	2·43	10·11	0·42	0·95
7. Maintenance	0·01	0·04	0·48	2·00	1·74	7·24	0·30	0·69
8. Wages..	0·01	0·04	0·68	2·83	2·49	10·36	0·43	0·98
9. Warehousing, &c.	0·02	0·08	1·00	4·16	3·64	15·14	0·63	1·43
1. Molasses	0·32	1·33	15·00	62·40	54·66	227·40	9·44	21·46
2 to 9 Expenses	0·27	1·12	11·79	49·05	42·72	177·72	7·42	16·87
Total Expenditure..	0·59	2·45	26·79	111·45	97·38	405·12	16·86	38·33

MEMORIAL SUBMITTED TO THE WAYS AND MEANS COMMITTEE, WASHINGTON, JANUARY 6TH, 1890.

(Published in the *Louisiana Planter.*)

The sugar planters of Louisiana, represented by a strong committee of leading men, including the well-known names of Mr. John Dymond and Mr. W. C. Stubbs, Editors of the *Louisiana Planter*, have drawn up the following statement, which is interesting as an able *résumé* of the situation :—

The domestic sugar industry of the United States is to-day one of the most promising, if not the most promising of all the agricultural industries of the country, and since the beginning of the new sugar industry in 1864, when the crop was but 5,000 tons, it has made more rapid progress under more difficult conditions than has any other agricultural industry of the country. The chief development occurred in Louisiana, and during the rest of the decade, ending with 1870, the annual production so increased that the average reached 38,000 tons per annum. During the next decade, ending with 1880, the annual average rose to 93,000 tons, an increase of about 145%. The nine years of the present decade thus far show an annual average of 133,000 tons, an increase of 43 per cent., and it requires no sanguine judgment to say that the average for the next decade will double the increase of either of the past. The average of the past three years has been about 165,000 tons, which quantity exceeds the production of any other country from tropical cane, except Cuba, Java, and Brazil.

This great increase in our domestic sugar production has been brought about under difficulties without parallel in its history, and which made success seem almost impossible. The cost of labour remained comparatively constant, while the prices of sugar fell off two-thirds. The enormous increase of the beet sugar crop of Europe steadily lowered prices of sugar, and it was only the most intense efforts in the direction of excellence and economy that enabled the planters of Louisiana to withstand the shrinkage in values and to increase their crops.

Those efforts in Louisiana for better work have gradually led to the adoption of all the best methods, and have placed Louisiana in the front rank of enterprise and excellence in sugar manufacture.

Scientific investigations have been inaugurated, all that had been done by the general government in Kansas for sorghum was availed of and all that had been done in Europe for the beet was also utilized, so far as it was applicable to our tropical canes.

Concurrently with our work in Louisiana, has come to development and success of the beet sugar industry in California, and of sorghum in Kansas. The great amount of light thrown upon sugar production, the outcome of scientific investigations of the general government, and of our own experiment station, have now awakened every man interested in sugar to the enormous capacity of this whole country for sugar production. Louisiana Texas, and Florida are now actively engaged in enlarging their sugar culture, and Mississippi, Alabama, and Georgia, have thousands of acres of lands well adapted to cane culture, that with our increasing knowledge will soon be brought into it. Kansas has had its drawbacks, has gone too fast perhaps in a difficult industry, has expected too much, and is somewhat disappointed, but the fact remains that she has discovered a crop that is better adapted to her lands than any other crop; that will make sugar in paying quantities, and which only needs time, patience and investigation to enable it to overcome all obstacles to success. The beet sugar industry has become an accomplished success in California, and while it takes some time to induce a farming community to engage in any new industry, yet, it has been done in California, and is made a financial success. A most brilliant success has just been made in beet sugar in Kansas, where 166 pounds of sugar 99 per cent. pure have been made per ton of beets from an experimental field of four acres; the total crop of 60 tons giving this result.

With the new discoveries that have been made with the application of all the skill of the chemist and of the mechanic, the domestic sugar industry of the country stands to-day more promising from an agricultural and manufacturing point of view than ever before in its history.

The capacity of the United States to produce its own sugar admits of no doubt. The alluvial lands of Louisiana that are readily drained are not yet one-third under cultivation, and adequate drainage works will bring millions of acres more into use. The introduction of new and hardy varieties of tropical cane that will withstand 5 to 6° F. greater cold than the old varieties, will extend the culture above the northern line of Louisiana, and where tropical cane culture ends,

sorghum culture should begin, and this plan seems to flourish up to the northern limits of Kansas, and here beet culture may begin and extend a long distance north. This culture now inaugurated in Kansas will be increased there this season, and a new factory is constructing for Nebraska.

Tropical cane culture is now a success in Florida, and thousands of acres of fertile lands there are now preparing for it.

Texas has an immense area of lands well adapted to cane culture, and has gone extensively into it during the last few years, adopting all the new methods, including diffusion.

It may be proper to speak of sugar from a politico-economic point of view. Its production has been fostered in Europe by legislation for nearly a century, and yet the extraordinary advance in methods and increase in results that now affect us have only become apparent during recent years. Fifteen years ago beet sugars cut no figure in our markets. Now they control the values of sugar throughout the world. All this seems to have been brought about by legislation favourable to beet sugar, and the various European Governments that have been requested by Great Britain to enter into a Convention for a suppression of the so-called sugar bounties, seem now, without exception, to refuse to make any change in their laws, fearing to do anything that might imperil the sugar industry, it being of such vital importance to the State wherever carried on. To show how sensitive is the beet industry of Europe to favourable or unfavourable conditions, we should state that the recent rise in sugar brought about by a clique of German speculators so stimulated the production of sugar there that the present crop shows an increase of some 500,000 tons.

This half million tons is a surplus that must be dumped upon the American market, and must, of course, seriously affect values here. France, Germany, Austria, and Russia thus making their own sugar and about all else that they consume, will want to sell us their sugar and to buy nothing from us, but to take our money. This absorption of our money for sugar assumes a serious aspect when we consider that we send abroad $100,000,000 now, and that we shall soon need to send $200,000,000, unless we develope the domestic sugar industry.

To us in Louisiana the sugar industry is of vital importance. We have invested over $100,000,000 of capital, and the industry gives employment and support to over half our people. Our lands are better adapted to cane culture than to any other. The crop is the

most certain one we know of, and withstands the vicissitudes of the season better than any other. A total crop failure is unheard of, the most disastrous seasons yielding one-half a crop. With these advantages have come the disadvantages of old methods, imperfect machinery, high cost of labour, inadequate capital, and falling markets. We have been struggling against these disadvantages all these years, but with the success that we have stated, and we are anticipating better results every year. Our levee system has been so strengthened that we are now hoping for entire immunity from the floods formerly so disastrous.

The sugar crop of Louisiana is of special importance to the whole country in this, that its advent lowers the level of sugar values for the whole country. This reduction of values on all sugar, foreign as well as domestic, gives the consumer a benefit as long as the Louisiana crop lasts that largely counterbalances the tax he pays on sugar.

The sugar crop of Louisiana is of vital importance to the whole country, because of the immense interstate trading arising from it. This now amounts to some forty millions of dollars per annum. No other State in the Union buys from the north and west so nearly all it consumes. The twenty millions of dollars received for the sugar crop, goes to the coal, iron, and oilmen of Pennsylvania, goes for the corn and meats of Ohio, Indiana, Illinois, and Kansas, goes for the furniture, dry goods, boots and shoes, hardware and harness of the northern States, and creates a trade almost equal to that of the United States with all the West Indies.

We submit that if our statements to you are found to be based on facts, is it not wise and just that our industry should be protected to the extent that will enable us to produce our own sugars? We submit that there is no other agricultural interest in which the possibilities are to-day so great. We ask only a calm, deliberate consideration of the industry.

All of which is respectfully submitted,

JOHN DYMOND,
JOHN FOOS,
W. C. STUBBS,
H. C. WARMOTH,
Committee.

THE SEYFERT PROCESS OF REFINING.

BY M. E. LÉGIER.

From the *Bulletin de l'Association des Chimestes.*

Side by side with the Steffen process, in which the raw sugar or the masse-cuite are washed by saccharated solutions of different densities, producing a white sugar, another process appears to attain the same end. This is the Seyfert process, which uses a paraffin oil as the medium of clarification.

The fundamental principle of the two processes is the same, *i.e.*, methodical washing, so as to separate the raw sugar or masse-cuite into their elements, sugar and molasses. The advantage over the old processes of remelting and turbining, which the new process appears to possess, consists in obtaining sugar fit for consumption by one single operation, the molasses being at the same time diminished in quantity.

The paraffin oil used in the Seyfert process has a boiling point of from 220° to 250°. The masse-cuite, after being turbined, is clarified by the paraffin oil, which carries off every trace of the molasses adhering to the crystals. The clarification is so perfect, that any further clearing by means of water becomes needless.

The syrup and the oil run off into a vat where separation rapidly takes place owing to their densities. The oil, being lighter, rises to the top, and is drawn off to serve for a fresh operation.

In this manner white and dry sugar is obtained in twenty to thirty minutes, and its weight corresponds with the quantity of crystals contained in the masse-cuite.

The sugar still retains a small quantity of the oil, the disagreeable taste of which prevents the product from being available for direct consumption.

By remelting and boiling, *i.e.*, in the process of refining, this taste is completely got rid of.

When raw refining sugar is treated, it may be turbined mixed with paraffin oil alone, or with oil containing white paraffin in solution. In this case the yield obtained is a maximum, and the sugar may be used directly as a charge for remelting.

The following trials, made at the Waghäusel manufactory, have given as results:—

Ordinary working: 100 sacks of raw sugar, polarisation 95·8, gave 65·24 of white sugar, 28 per cent. of residual products, and 6 per cent. of molasses.

Working with paraffin oil: 100 sacks gave respectively 86·22, 4·85, 8·25 of corresponding products.

These results have induced the managers to adopt the Seyfert process on a large scale.

THE SUGAR TARIFF IN THE UNITED STATES.

From the *New York Merchants' Review.*

The dominant party in the House of Representatives has for some time been in a quandary as to the expediency of reducing the sugar duties, but it is believed that a majority of the Ways and Means Committee have at last made up their minds in favour of a 50 per cent. reduction, and that a bill will soon be reported on that basis. The friends of the domestic cane, sorghum and beet interests are all united in opposition to any reduction of the duties, and have brought over several Republican members to their side. As the Republican majority is narrow, this would endanger the success of the bill, but the Washington correspondent of the *Daily Commercial Bulletin* reports a disposition on the part of a number of Democratic members of the House to vote for a reduction, and it is thought that a sufficient number can be secured to offset the defection of the Republican Congressmen who may have been convinced by the arguments of domestic producers. The present ad valorem rates on sugars are about 80 per cent., the reduction proposed will bring them down to about 40 per cent. The effect of such a reduction will soon be felt in an increased consumption of sugar in all its forms. The grocer's sales will expand greatly and a larger demand will spring up for all food products in which sugar is used in any considerable quantity. The domestic manufacturers of preserves, confectionery and canned goods will be better fitted to successfully meet the competition of foreign manufacturers in the home market, and a respectable sum will still be left for the expenses of the Government. The *Merchants' Review* would welcome a greater reduction, but the grocery trade will probably be satisfied, provided the question is settled soon on the basis proposed, as they will have an opportunity to obtain a small profit on the article.

DIFFUSION IN LOUISIANA.

From the *Louisiana Planter*.

Diffusion in Louisiana is at last an accomplished and a profound fact which must rejoice every true friend of progress, and insure to the cane growing world renewed confidence and vigour.

Of the nine large batteries at present in Louisiana and Texas, one only has failed to harvest successfully, and without the assistance of milling, the crop intended for it. The erection of Mr. Willis's battery was not begun or completed in time to allow of this triumph, and a portion of the Boy Blue crop was crushed at home, instead of being conveyed to the Glenwild battery, which, however, manufactured the entire Glenwild and Fairview crops.

As may always be expected of new and especially of novel apparatus, this past season's broad success with diffusion has been attained only after innumerable minor delays and vexations, which have, however, so served to clear the path as to assure hereafter a continuity in battery work equal to the cane mill's best attainment. The crop of the Magnolia plantation was, indeed, harvested with probably less detention than that of any considerable mill estate in the entire sugar belt.

With larger experience of the process, most of its old difficulties have disappeared. Means for the successful production of a satisfactory chip have been found, and methods for conveying these to the individual cells have been developed. The old time difficulty of emptying the cells of their exhausted chips has been altogether forgotten, and experiments in at least one case have demonstrated the entire feasibility of burning these with even high economic effect. The bugbear of inversion in the battery and of difficulties in defecation, concentration, and crystallisation have likewise vanished. It is discovered also that diffusion juices are no more susceptible to fermentation than are mill juices of like density, while at least a partial clarification and the mechanical filtration which occurs in the cell prove most advantageous. An important economy, further, is gained in the suppression of scums and sediments, and the objection heretofore urged respecting dilution has, at the same time, been silenced by the application of maceration wherever double crushing is in vogue, as by the adoption of multiple effect evaporation. Magnolia and Des Lignes, of which the former made no attempt whatever to consume the exhaust chips, both report an amount of coal burned

per thousand of sugar which has only been surpassed in economy by perhaps a scant half score of Louisiana's best mill establishments.

There appears to be left, then, only the problem of how best to remove the exhausted chips mechanically from under the battery, and how automatically to so spread these upon the mill carriers as to insure proper rolling for perfectly successful combustion.

Notwithstanding that the essential conditions of battery construction, erection, and management have come to be fully known to our constructing engineers and a large force of men trained to its conduct (rendering capital, not courage, as hitherto, the prime necessity of its installation), it will be well if those contemplating diffusion for the next campaign set immediately about their arrangements for this. In this way only can be avoided as many as may be of those inevitable stoppages and annoyances incidental to new plants of whatever nature. We have already learned of contracts under advisement for two additional batteries. For each of these there should be planted patches of sorghum, with which to make early test of cutters, drags, and their concomitants. It has been these accessories which, with only one exception, seem to have caused all the irregularity encountered by diffusion establishments this season.

Other parties, also, are known to have the diffusion bee in their bonnets, which leads to the reflection that such enterprising firms from abroad the state as desire contracts, and are willing to guarantee reasonable results, should lose little time in placing their advertisements in our columns and their agents in our midst. Notwithstanding a short crop just past, progress proposes no halt. An inevitable and important falling off in the number of heavy mills to be constructed this year must be interpreted as progress in the right direction.

The consequences of diffusion are not going to end with an increased amount of sugar extracted from the cane. In compelling the universal adoption of multiple effect evaporation it will confer a collateral benefit of scarcely less importance with the increased juice extraction. The unprecedented yields which it will be found to insure must also soon render apparent the tremendous economic loss inseparable from small manufacture, with inferior appliances, and will, therefore, furnish a powerful motive for the abandonment of such for concentration in large and complete establishments, together with all that this step implies. It involves also a chemical control, the beneficial influence of which is already beginning to be felt in all departments of the business, field, and factory. It means progress all along the line.

THE BAUDER ELECTRIC PROCESS OF REFINING SUGARS.

From the *Louisiana Planter*.

This invention, which has been patented in France and England as well as in this country, is so remarkable in its claims that we give to it a considerable space. The processes which have been heretofore used in refining sugar are of a slow, difficult, and expensive nature. Whatever chemical or mechanical processes are employed, the following operations have to be performed: First, dissolving or melting the sugar; second, clarifying the same; third, filtering and discolouring; fourth, boiling; fifth, cleaning; sixth, bleaching; and, seventh, drying the same.

This invention consists, in its general outlines, in a process of refining sugar by subjecting the mass in a dry state to the action of steam, so as to moisten and heat the same, and to the bleaching action of ozone generated by electric sparks passed through the moistened mass, while the same is simultaneously rotated in a centrifugal machine, so as to drain off the syrup. After the bleaching action is completed the mass is crushed, bolted, and moistened, and then pressed into suitable shape.

In this process of refining sugar the sugar is taken in crystallized condition as it is delivered by the planter, and first thoroughly ventilated by forcing air through the same for removing thereby adhering dust and other impurities. If the crystals in the sugar are of medium size they are left as they are, but if the crystals are of larger size they are crushed, so as to reduce them to a smaller size. For this purpose an ordinary crusher is used without reference to the larger or smaller size of the crystals or of the powder in the same. The mass of sugar is next transferred to a centrifugal apparatus provided with a steam-jacket, which communicates by a pipe, having a regulating stop cock, with the rotary perforated basket of the machine. The steam may be of high or low pressure. If the pressure does not exceed six atmospheres, the mass of sugar is put into the centrifugal machine in a perfectly dry state, as the moisture produced by the steam is sufficient for the bleaching operation. If steam of higher pressure is used, the mass of sugar has to be moistened to the required degree by an atomiser, so as to compensate for the more or less dry condition of the steam.

The centrifugal machine is closed by a hermetically fitting cover, which is provided with means for supporting the electrodes that are connected by conducting wires with a dynamo electric machine or other suitable source of electricity. The ends of the electrodes or poles are arranged at a greater or smaller distance from each other according to the intensity of the current employed, so as to obtain a constant spark between the poles. The cover also serves to tightly close the centrifugal machine, so as to maintain the high temperature imparted by the steam jacket and steam to the interior of the centrifugal machine. After the mass of sugar has been placed in the basket of the centrifugal machine the same is rotated and the mass first subjected for about ten minutes to the action of steam, which has for its object not only to purify the sugar to a certain extent, but also to moisten it and prepare it for the action of the electric current.

The joint action of the heat and moisture on the crystallized sugar places the same in a better condition to be acted on by the ozone generated by the electric current, while the mass in its dry state would only very indifferently respond to the bleaching action of the ozone. When the mass is properly heated and moistened, the electric current is permitted to pass between the electrodes at the interior of the centrifugal machine, the current being maintained for about forty minutes, either continuously or intermittingly, according to its intensity and the quality of the sugar to be treated. The admission of steam may be kept up continuously or intermittingly for a longer or shorter time, according to the pressure of the steam; but it has to be stopped at least ten minutes before interrupting the current and stopping the centrifugal machine.

The strength of the electric current varies according to the quality to be treated and the speed with which the operation is to be carried out. When the draining of the mass by the centrifugal action of the machine is completed, the sugar crystals are obtained in refined state, while the syrup has been drained off. This syrup undergoes a separate treatment, which will be described hereinafter. The refined crystals are then removed from the centrifugal machine and submitted to a crushing action by means of a crushing mill of any approved construction. As by the crushing action some pulverised sugar is produced, the crushed crystals are passed through a boiling machine, having a bolting cloth of silk or metallic gauze.

The crushed and bolted sugar is then moistened moderately with filtered water by means of an atomiser, and then submitted to

pressure. In this condition the mass of sugar can be moulded into various sizes and shapes, so as to form either plain or perforated blocks or cones or small cubes like the ordinary lumps in use. These blocks or pieces are next subjected to heat for a greater or less length of time, according to the size of the same, which imparts to them the dryness and hardness of ordinary fine sugar. The sugar can also be sold directly after being crushed and bolted, in which case the buyer can afterward subject it to the moistening, compressing, and moulding operations. After completing the foregoing operations there remains the syrup and the powder obtained by the same for further treatment. These two substances may be united in such proportions as to obtain a thick mass composed of unrefined portions (syrup) and refined parts (powder). This mass is transferred to the centrifugal machine and subjected to the moistening, bleaching, and draining operations before described, which will be continued until the syrup is exhausted. The syrup and the powder can also be added to a new quantity of sugar, provided the syrup does not contain more moisture than would be supplied by the steam. If, after passing through the different operations, the residue of the syrup should contain impurities, it may be clarified by the processes employed by refiners. The thus clarified syrup is then converted into crystals in a centrifugal machine by mixing it with powdered sugar or crushed sugar. The crystals thus obtained will then be again submitted to the refining operation before described.

The different steps which together form this process can also be applied directly (instead of sugar already crystallised) to the mass of sugar before crystallisation by introducing the same into the centrifugal machine and subjecting it to the different steps of the process. In this manner the only operation which is now performed twice—namely, the draining off of the syrup by centrifugal operation, which is done first by the manufacturer and then again in refining—can be performed in one operation.

The advantages of this process are that instead of employing the wet process and the many complicated operations which it requires, the sugar is refined by a dry process, which requires but three or four operations of great simplicity. The sugar is refined without destroying the crystals, whereby the plant required is greatly simplified and rendered much less costly. The time required for refining sugar by this process is reduced to a few hours, while heretofore it has taken from fifteen to twenty days. The refining operation can also be accomplished by the planter without being carried out in special refining establishments.—*Journal of Useful Inventions.*

TILE DRAINAGE SCIENTIFICALLY EXPLAINED.

A Paper read before the Ascension Branch of the Louisiana Sugar Planters' Association, by Mr. Adolph Thiel.

From the *Sugar Bowl.*

At the meeting of your Association at New Orleans, on the 14th of last month, while discussing the subject: "The price of sugar cane and its equitable adjustment to the price of sugar manufactured therefrom," the fact was established that hitherto no definite rule had been decided upon which would even approximately settle the value of cane, for the reason that in years when there is a heavy tonnage, the percentage of sucrose is lighter; while in other years, as the present, for instance, though the tonnage is lighter, the percentage of sucrose greater.

As the raising of cane on the tenant plan is gaining ground from year to year, it may be well to investigate into the causes of such variation in tonnage and percentage of sucrose. I have made inquiries which resulted in the information that in seasons of abundance or excess of rain, the cane makes a strong and rank growth; but unless there be a very dry ripening season, the stalk becomes surcharged with water to the exclusion of sucrose. If the season should happen to be drouthy, the stalk will be smaller, though containing a richer juice.

The problem then is to obviate these extremes—to find out the faults and apply the remedy. As I stated before, my inquiries resulted in the information that a heavier tonnage with less percentage of sugar was obtained in wet seasons, and *vice-versa. The fault, then, is in deficient drainage; the remedy in improved or perfect drainage.*

But how can you improve your present mode of drainage? We think it is practically out of the question to make your open ditches any deeper, and if you were to do even that the same obstacles, such as annual cost of cleaning out the open drains and bridging them, the loss of land and fertilizers, inconvenience of cultivation and the excellent harbour that the weeds find on the ditch banks, would make you still adhere to your present system of open drainage. You can no longer afford to ignore the laws of evolution and progress in this matter, which demand that you supersede your open ditches by tile. The use of tile is an application of scientific principles without

which a rational system of agriculture cannot be maintained or even exist in these lowlands of Louisiana, the soil being composed of alluvion and decayed vegetation, where the stagnant water stands six months out of twelve too close to the surface to permit the roots of cane, your principal crop, to grow deep and strong and send out the numerous rootlets (fibrous roots) which are the actual feeders of the growing plant.

Since I have claimed that tile drainage is your alternative, I will apply myself to explain to you the great advantages gained thereby.

First. All the obstacles that I named in the beginning as attached to open drainage, are removed by the use of tiles. There being no open channels to which the water can escape, it is compelled to sink through the pores of the soil to the depth of the tile; as the pores become opened they hold the moisture, only the surplus running off, consequently more moisture is retained in the soil.

Second. The air and warmth enter the pores, warm the soil and make the substratum accessible to the roots. This advantage is of the greatest importance to the successful growth of cane, which is a semi-tropical plant and needs plenty of heat for its growth and maturity. To demonstrate why a porous soil will warm quicker than a compact heavy soil, I shall use a steam boiler for an illustration. It is not so very long ago that the fire was applied under the boiler only and then escaped into the chimney; now, when we have boilers with return flues, the heat is used twice, producing more steam at a saving of fuel; but if you were to close the ends of the flues they would be worthless. The same principle applies to drainage; let the water run over the surface, depositing sediment in the pores of the soil and closing them, no heat can enter any depth. Speaking about heat, I will call your attention to another effect produced by heat in connection with under drainage. No doubt you are aware that heat causes the expansion of bodies. By opening the pores of the surface soil, we admit warmth and moisture, which causes the expansion of the substrata to such an extent as to open the seams and pores thereof and make it available to the growth of the roots.

Third. By opening the substrata the roots will penetrate deeper and spread more, furnishing the stalk with more feeders, promoting a strong and healthy growth, endowing the plant with greater tenacity. An excess of wet weather cannot affect it so easily, because its absorbing power is greater, thus helping in getting rid of over saturation of

the soil; a spell of dry weather cannot hurt it so easily, because a strong healthy plant, with plenty of foliage, will absorb a great deal of moisture from the air, while the deeper roots, assisted by capillary attraction, will keep the plant supplied with food and in a growing condition. Abundant foliage on a plant shades the ground, prevents the parching of the soil, and creates humidity in the atmosphere, while in case of a heavy windstorm the deep strong roots act like unto the guyrods of a smokestack, bracing and preventing the breaking down of the stalk.

Fourth. I stated previously that cane is a tropical plant. But owing to the narrow shape of the American continent and other geographical and topographical conditions, we are frequently visited in this latitude with the rigours of the Northern climates, which check the growth of tender plants, hence we must look to an expedient that will secure us more tropical conditions of the soil to counteract the cold northern waves. By opening the pores of the soil we not only admit air and warmth, but by the storage of moisture we increase the latent heat *of* and insure the normal temperature *in* the soil. A cold snap then in the spring will have less effect in checking the growth of a crop, because the greater heat in the soil will stimulate the roots and keep them performing their functions, thus counteracting the lower temperature above the surface.

Fifth. The importance of seasonable cultivation must not be overlooked. The proverb, that "a stitch in time saves nine," applies here as much as in any other case. But you will perhaps be provoked to a smile when I tell you that your present method of cultivation appears altogether too laborious; and may be you will smile a little more at my assertion, that with thorough tile drainage easier and improved methods of cultivation will suggest themselves to you.

Sixth. Underdrainage, by opening the pores of the soil, accelerates and facilitates capillary attraction. Now, if we consider that capillary attraction is the process by which the sap is absorbed from the soil and carried upwards in the plants, the water being evaporated by the leaves, but the substances which build up the plant being retained, we must come to the conclusion that we should not only drain with a view to remove a surplus of water, but the aim should also be to open the pores of the soil to admit air and warmth so that the temperature of soil and moisture may be raised to such a degree as to make

capillary attraction easy. In my experiments with capillary attraction, using glass tubes, to determine the various stages of height to which the water will rise in the capillary cells, I find that the higher the temperature the higher the water will rise. This result is undoubtedly due to the fact that if the water is colder it is heavier and more rigid, or the warmer it is the lighter, hence less affected by the law of gravitation, and consequently more apt to rise in the capillary cells.

Then again, remember that it takes a certain amount of heat to cause the assimilation of moisture and the fertilizing elements of the soil into plant food, and that with increased capillary attraction more sap is forced into the cane, and while the water is evaporated through the leaves the sucrose is retained in the stalk.

Thus much I have to say to-day for the advantages of underdrainage during the growing and cultivating season, and I will only add that it lengthens the season by warming the soil earlier in the spring and keeping it warm longer in the fall. But as previous experience has proved that a wet spell during the ripening season does surcharge the stalk with water to the exclusion of saccharine, no better remedy can be applied than the laying of tile to prevent oversaturation of soil.

A great deal more could be said and written on this subject, but I will close with the remark that you cannot be fully and thoroughly convinced of the advantages and benefits of tile drainage until you individually and separately try it yourself.

Correspondence.

PATENT AND TRADE MARK LAW IN AUSTRALIA.

TO THE EDITOR OF "THE SUGAR CANE."

Sir,—Many of your readers interested in the trade with Australia will be pleased to learn that by advices just to hand from the Colony of Victoria we have received copies of two Acts which have recently been passed in that colony, one relating to Fraudulent Marks on Merchandise, which came into operation on the 1st inst., and the other to Consolidate and Amend the Law relating to Patents, which is to come into force on the 1st of March. The former of these to be known as "The Merchandise Marks Act, 1889," repeals "The Trade Marks Statue of 1864," and provides that every person who forges

any trade mark, or falsely applies to goods any trade mark or any mark so nearly resembling a trade mark as to be calculated to deceive; or makes any die, block, machine, or other instrument for the purpose of forging or of being used for forging a trade mark; or disposes of or has in his possession any die, block, machine, or other instrument for the purpose of forging a trade mark; or causes any of the above-mentioned things to be done, or who sells or exposes for sale any goods with a forged trade mark, or false trade description, shall be guilty of an offence against the Act, and shall be liable to imprisonment with or without hard labour for a term not exceeding two years, or a fine not exceeding £200, or both imprisonment or fine and the forfeiture of every article bearing the false mark or description. "The Patent Act, 1889," repeals all previous Acts bearing on the subject of patents, and in the main adopts the principal provisions of the English Act, 1883, and subsequent amending Acts, so far as they relate to Patents. The Commissioner of Patents is, however, invested with larger powers in some respects than the Comptroller in England, inasmuch as he can refuse the grant of a patent should either of the examiners report that to the best of his knowledge the invention is not novel. All decisions of the Commissioner are, as in England, subject to appeal to the Law Officers. In the colony, however, should the Law Officer decide not to grant a patent, such decision may be reviewed on appeal to the Supreme Court. The renewal fees on patents are reduced so that on only two occasions during the life of the patent a tax of £2 10s. has to be paid.

Wm. P. Thompson & Co.,
Patent Agents, Manchester.

30th January, 1890.

CLERGET'S METHOD OF INVERSION.

To the Editor of "The Sugar Cane."

Sir,—In Number 246, January, 1890, of *The Sugar Cane*, I find a "Report of the Committee of the Louisiana Sugar Chemists' Association on Methods of Chemical Analysis," describing experiments, executed for the purpose of finding "the correct expression of the formula used in connection with Clerget's method of inversion" and to test the correctness of Landolt's revised figure of 142·4, "the inaccuracy of results obtained by the use of Clerget's original constant of 144 having become apparent." In the conclusion of the

article the Committee recommend "the use of the constant 142·4 in all such determinations hereafter." From the description of the experiments executed, and the results obtained by such experiments, and from the conclusion derived from said results, it appears clearly that the experiments have been faultily executed, and that the authors of the report are not acquainted with the literature appertaining to the subject. The above recommendation will embarrass and mislead those, who like those using polarisation on sugar plantations, &c., have not the knowledge and skill to test chemical methods themselves, but who may still be in a position to apply Clerget's method of inversion; and it will give rise to doubts as to the true merits of said method with chemists who are not conversant with the subject. This is the reason which induces me to make a few remarks on the report, and to point out the main errors contained therein. By the report we are informed that a normal solution of saccharose, which polarised 100·0 at 17·5° C., polarised only 99·7 when reduced to a temperature of 4° C. There is no explanation given for this remarkable result, which stands in opposition to experience and science. It is well known that the specific rotatory power of the saccharose is affected only minimally by the temperature ("Dubrunfaut Ann. Chim. Phys." (3) 18, page 99, *vide* Tollens, "Die Kohlenhydrate," page 124.) The difference of polarisation can therefore not be explained this way. By reducing the temperature of the solution from 17·5° C. to 4° C., the density of the solution is increased, while the length of the tube is slightly reduced. Mategczek gives for Ventzke's scale a table, showing the polarisation of a saccharose solution prepared at 17·5° at different temperatures. From this table I quote: Polarisation at 17·5° 100·0; polarisation at 10·0° 100·17. Therefor it would reasonably appear that at 4° C. the polarisation of the solution should be 100·3 to 100·4, and not as stated 99·7.

The report says that 50 c.c. of this normal saccharose solution were inverted in the manner described by Clerget, and this inverted solution polarised at temperatures near 0° 0. From the results of these polarisations, which were certainly too low (too low left hand rotation) for some reason, of course unknown to me, the authors of the report conclude: "These results would appear to confirm very fully the correctness of the constant 142·4 as obtained by Landolt." And thereby, without much ado, is condemned a method and a formula recommended, tested, and retested by chemists of high

standing and authority. The above results of the Committee, however, do not by any means confirm the correctness of Landolt's constant. This 142·4 found by the Committee is not the 142·4 found by Landolt, as Landolt determined his 142·4 for a solution containing one-half normal weight of saccharose in 100 c.c., and not like the Committee, for a solution containing one-half normal weight of saccharose in 55 c.c. Gubbe and others having shown that the rotatory power of invert sugar solutions increases with the concentration of the solution and the amount of acid employed for the inversion, the difference between Landolt's 142·4 (and Creydt's 142, and Herzfeld's 142·66) and Clerget's 144 is easily explained. There is, therefore, no need to change Clerget's original constant and formula (except, perhaps, for Tuchschmid's revised formula), as Clerget's method and formula give for all practical purposes sufficient reliable results, provided the inversion, polarization, and reading of temperature are executed with care and skill. I am fully aware of the well-founded objections raised against Clerget's method of inversion—against the use of the German half normal weight—while Clerget used the French half normal weight—against the concentration of the acid, &c.,—but still the application of the constant 142·4 for the calculation of the results, obtained by polarizing sugar solutions, inverted accordingly to Clerget, will cause a far greater error than all the other weak points of the method taken together.

Yours, &c.,

THEODOR BREYER.

New York City, 110, Front Street.

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, February 13th, 1890.

FAIR REFINING.	96o/o CENTFS.	GRANULATED.	STAND. A.	STOCK IN FOUR PORTS.
Feb. 13, 1890.—5 1-16c.	5⅝c.	6⅜c.	6⅛c.	Jan. 1, 1890— 11,169 tons.
Feb. 14, 1889.—4 13 16c.	5 9-16c.	7c.	6⅝c.	Jan. 1, 1889— 32,254 tons.
Feb. 16, 1888.—4¾c.	5 7-16c.	6¾c.	6⅜c.	Jan. 1, 1888— 47,798 tons.
Feb. 17, 1887.—4 9-16c.	5 3-16c.	5 11-16c.	5 5-16c.	Jan. 1, 1887—102,279 tons.
Feb. 18, 1886.—5¼c.	5⅞c.	6⅜c.	6c.	Jan. 1, 1886— 57,328 tons.
Feb. 19, 1885.—4⅞c.	5⅝c.	6⅛c.	5¾c.	Jan. 1, 1885— 89,186 tons.
Feb. 14, 1884.—5⅞c.	6¾c.	7⅛c.	7⅛c.	Jan. 1, 1884— 60,900 tons.
Feb. 15, 1883.—6 15-16c.	7⅝c.	8¾c.	8⅜c.	Jan. 1, 1883— 50,297 tons.
Feb. 16, 1882.—7c.	7¾c.	9¼c.	8¾c.	Jan. 1, 1882— 43,927 tons.
Feb. 17, 1881.—7⅛c.	8 1-16c.	9 1-16-⅛c.	8⅝c.	Jan. 1, 1881— 66,999 tons.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. THOMPSON, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

416. C. W. GUY, London. *Improvements in apparatus for extracting the juice of sugar cane and other substances.* 9th January, 1890.

606. J. BROCK and T. MINTON, London. *Improvements in filter presses.* 13th January, 1890.

647. M. B. DODGE, London. *Certain improvements in crushing and pulverizing mills.* (Complete specification.) 14th January, 1890.

1082. G. C. TOPP, London. *Improvements to prevent hydrometers and saccharometers lactometers rotating and to strengthen the same.* 21st January, 1890.

1247. A. FAIRGRIEVE, London. *Improvements in the manufacture or production of raw or refined sugar, and apparatus to be used therein.* 23rd January, 1890.

1282. C. B. ABEL, London. (Communicated by the firm of Pfeifer & Langen, Germany.) *Improved treatment of sugar crystals or grains for facilitating the purifying or washing thereof.* (Complete specification.) 24th January, 1890.

ABRIDGMENTS.

4121. F. DEMMIN, of Königgratzerster, 91, Berlin, Germany, civil engineer and manufacturers' engineer. *Improved method for cleansing or whitening sugar in the centrifugal machine, and apparatus therefor.* March 8th, 1889. This process consists in collecting the purifying liquor flowing from the centrifugal machine, in general portions of different degrees of purity, and using them again in similar subsequent operations. The centrifugal is so arranged in combination with a collector that the various portions of liquor may be kept separate and distinct.

19728. W. THOMPSON, of Beheea, Shahabad, Bengal (temporarily of 10, Belsize Avenue, St. John's Wood, London); ZEMINDAR and J. B. ALLIOTT, of Bloomsgrove Works, Nottingham, engineers. *Improvements in apparatus for the expression of juice from sugar cane.* December 11th, 1889. This relates to portable apparatus, and parti-

cularly to such as is described in Patents 4038 (1881) and 11618 (1885). The present improvements relate to (*a*) the construction of the frames of such apparatus wholly, if wrought or rolled metal such as iron, or partly of metal and partly of wood, in such a manner that they shall be strong and rigid. A number of different constructions are shown, and fifteen views are given to illustrate them. (*b*) An arrangement enabling the roll shafts, rolls, and toothed wheels for driving the same, to be readily and quickly taken apart and replaced by unskilled persons, and whilst the apparatus is in the field or other place away from the workshop; (*c*) improved means for preventing the sugar cane treated from passing upwards and between the toothed wheels and rolls.

GERMAN.

ABRIDGMENTS.

48623. SANGERHAUSER ACTIEN MASCHINENFABRIK UND EISENGIESSEREI, vorm Hornung & Rabe, Sangerhausen. *Knife-boxes and shredding cylinder for shredding machines.* 25th December, 1888. The knife-boxes as well as the shredding cylinder are made so as to be open at their periphery, as well as closed, thus permitting the shreddings which gather before the knives to pass out in a sidewise direction.

49120. CARL STEFFEN, Vienna, and the firm of LANGEN and HUNDHAUSEN, Grevenbroich. *Improved centrifugalling apparatus.* 16th June, 1888. In this centrifugal the cane shapes in which the sugar loaves are centrifugalled are inserted through the openings in the movable drum and rest therein. These openings are arranged in several rows over one another, so that the canes are not fixed as before in the inside of the drum, but are placed in the wider space between the movable drum and the outer fixed jacket of the centrifugal, thus enabling a larger number of sugar loaf forms to be placed in the same centrifugal than was the case under the old method.

49146. W. P. ABELL, L'Union, Essequibo, British Guiana. *A conveyor for sugar centrifugals.* 21st February, 1889. A trough-shaped receiver is fixed underneath the centrifugals, into which the sugar which has been centrifugalled falls in order to be transported from the conveyor warm, which is fixed to the bottom of the receiver, to the elevators. For the purpose of raising the conveyor in order to clean the trough, the axle journal is made so that it can be moved into holes placed at various distances apart in the sides of the trough,

and is provided with oval swivelling catches, which engage in grooves in their lower position, and lie upon the upper edge of the side of the trough in their upper position.

49913. W. GREINER, Brunswick. *Improved heating arrangement for vacuum boiling apparatus.* 4th April, 1889. Addition to Patent No. 31022, dated 16th July, 1884. The improvement on the perpendicular apparatus, patented under No. 31022, consists in forming the same of radial pipes fixed one over the other, which are arranged so as to fall in an oblique direction towards the discharge opening of the evaporator. Fixed to the ends of these pipes are two pipes for the purpose of admitting steam, and thus enabling the discharge of the condensation water.

49942. AD. MEHRLE, Friedrichsaue, and H. ANDREE, Nauen. *Insertion pieces for the suction vessels of sugar-lixiviating batteries.* Patented under No. 43484. 24th April, 1889. The suction vessels of Patent No. 43484 are simply shallow cylinders with perforated bottoms. The improved insertion pieces for the same consists of several perpendicular plates connected together; these separate the interior of the vessel into several parts. By this means the particles of sugar to be washed out are prevented from adhering together, and the wash or covering liquid has an unobstructed flow. A rope attached to pulleys serves for lifting out the apparatus.

50032. EUGEN KUTHE, Fröbeln, and ERNEST ANDERS, of Magdeburg. *Improvements in the separation and purification of beetroot sugar juices by aid of caustic lime.* 30th March, 1889. In order to promote the filtration of the sludge, precipitated calcium carbonate, obtained from the saturation of the clarified separated beetroot sugar juice, is added on separating with lime, this calcium carbonate being obtained from the saturation filter presses in an almost dry, crumbly condition. This process is preferably to the one usually employed, in that a smaller quantity of caustic lime and carbonic acid will be found necessary in the saturation process, and a perfectly clarified juice is obtained from the filter presses without the use of many filter cloths.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

January 1st to January 31st.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Germany	669,846	373,195	463,805	204,961
Holland	10,767	29,686	7,179	14,051
Belgium	92,340	119,259	54,785	52,847
France	18,431	205,266	12,168	122,512
British West Indies & Guiana	170,352	194,646	150,030	154,593
British East Indies	39,600	3,000	21,195	1,760
China and Hong Kong	....	....	....	....
Mauritius	5,095	....	3,580	....
Spanish West India Islands	....	....	....	....
Brazil	53,200	35,820	33,610	20,882
Java	26,000	18,000	20,150	14,400
Philippine Islands	21,965	9,200	10,570	4,065
Peru	54,300	98,470	40,300	66,094
Other Countries	99,648	49,803	58,363	34,561
Total of Raw Sugars	1,261,544	1,136,345	875,735	690,726
Molasses	14,611	5,894	5,498	2,382
Total Sugar and Molasses	....	....	881,233	693,108
Refined Sugars.				
Germany	487,374	374,668	433,996	304,668
Holland	100,901	146,663	91,750	122,583
Belgium	24,071	16,065	22,532	14,106
France	139,662	408,838	121,929	323,441
United States	4,493	29	3,650	41
Other Countries	*104,529	98	*86,788	73
Total of Refined	861,030	946,331	760,645	764,912

EXPORTS.—Refined Sugars.

	Cwts.	Cwts.	£	£
Sweden and Norway	3,423	10,126	2,628	7,158
Denmark	4,250	7,145	3,096	4,141
Holland	6,964	7,145	5,197	5,136
Belgium	2,988	2,865	1,954	1,941
France	503	155	379	112
Portugal, Azores, & Madeira	6,567	9,081	4,477	6,104
Italy	7,556	11,378	5,631	7,182
Other Countries	10,548	15,772	8,687	11,704
Total of Exports	42,799	63,667	32,049	43,478

* Imported almost entirely from Russia.

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of January, 1890, compared with the corresponding month of the two preceding years, and the average monthly imports for the past year compared with those of 1886, 1887, and 1888, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				Jan.	Jan.	Jan.	Monthly Average.				Jan.	Jan.	Jan.	Monthly Average.				Jan.	Jan.	Jan.
	1886	1887	1888	1889	1888	1889	1890	1886	1887	1888	1889	1888	1889	1890	1886	1887	1888	1889	1888	1889	1890
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France.............	1462	1363	1686	2373	2090	1828	3481	2688	5099	4855	8596	1851	5155	16961	4150	6462	6511	10969	3941	6983	20442
Holland	3508	3780	3267	2294	2922	2510	2970	1428	2483	2675	3354	2992	2535	4362	4936	6263	5942	5648	5914	5045	7332
Germany & Austria ..	990	1347	1510	2573	1770	2851	2629	6634	10463	11729	13844	12888	21517	16104	7624	11810	13239	16417	14658	24368	18733
Belgium	344	592	622	827	622	836	647	113	308	227	225	363	367	156	457	900	849	1052	985	1203	803
United States	854	454	8	..	..	..	..	5078	2804	157	42	177	225	1	5932	3258	165	42	177	225	1
Russia.............	..	3	..	23	..	..	..	3412	452	1959	2015	442	5226	..	3412	455	1959	2038	442	5226	..
Other Countries	..	..	1	239	..	..	..	9	15	2	355	..	..	5	9	15	3	594	..	..	5
Total	7158	7539	7094	8329	7404	8025	9727	19362	21624	21604	28431	18713	35025	37589	26520	29163	28698	36760	26117	43050	47316

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

TO FEBRUARY 15TH, 1890 AND 1889. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS.		DELIVERIES.		IMPORTS.	
	1890.	1889.	1890.	1889.	1890.	1889.
London	43	36	34	35	29	40
Liverpool ..	72	83	38	39	25	27
Clyde......	45	31	23	27	28	35
Bristol	3	3	12	10	11	9
Total ..	163	153	107	111	93	111
	Increase.. 10		Decrease.. 4		Decrease .. 18	

The above figures do not include Hull, Leith, &c., for which there are no published returns.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Circular.)

FOR THE FOUR PRINCIPAL PORTS. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND. FOR JANUARY, 1890 AND 1889.

	STOCKS. February 1st.		DELIVERIES. In January.		IMPORTS. In January.	
	1890.	1889.	1890.	1889.	1890.	1889.
New York	2	33	66	52	57	57
Boston	..	3	9	4	9	4
Philadelphia....	..	..	25	18	25	18
Baltimore	..	..	..	..	..	..
Total......	2	36	100	74	91	79
	Decrease.. 34		Increase.. 26		Increase .. 12	
Total for the year			—	1,030	—	1,009

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 31ST JANUARY, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	German Empire.	Austria.	Remaining four principal *entrepôts.*	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
165	300	73	537	291	30	1396	921	955

CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST JANUARY, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	German Empire.	Austria.	Remaining four principal *entrepôts.*	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
1313	490	41	424	257	357	2882	2766	2694

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1889-90.	1888-89.	1887-88.	1886-87.
	Tons.	Tons.	Tons.	Tons.
German Empire ..	1,250,000 ..	990,604	959,166 ..	1,012,968
France..........	750,000 ..	466,767 ..	392,824 ..	485,739
Austro-Hungary..	730,000 ..	523,242 ..	428,616 ..	523,059
Russia and Poland.	480,000 ..	526,387 ..	441,342 ..	487,460
Belgium	200,000 ..	145,804 ..	140,742 ..	135,755
Holland	60,000 ..	46,040 ..	39,280 ..	36,098
Other Countries..	80,000 ..	87,000 ..	79,980 ..	69,127
Total....	3,550,000	2,785,844	2,481,950	2,750,206

Mr. Licht's estimate is again 55,000 tons higher than that given by him last month, the differences being, for Belgium 5,000, for Germany 30,000, and for "Other Countries" 20,000.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

A tolerable business has been transacted during the past month, a fair amount being done in cane sugar for refining, which may be reported as slightly higher than last month, especially centrifugals and some of the coarser kinds. Refined sugars remain practically unaltered, but a tolerably steady trade has been done.

In beet sugar a strong tendency to advance was manifested during the second week of the month; this has been checked, and quotations close slightly lower, but, on the whole, a decided advance on last month's closing prices has been established, which is the more remarkable, inasmuch as, according to Mr. Licht, we have to look for an excess of about 760,000 tons for 1889-90 over the preceding campaign. It may be said that beet sugar at present rules the market.

Mr. Licht gives some estimates of the consumption per head for 1888-89, indicating for most countries a slight falling off. France, Belgium, Spain, Portugal, and Switzerland are, however, credited with a small increase. The average per head on an estimated population (1889) of $366\frac{1}{4}$ millions, is about $19\frac{7}{8}$ lbs. for 1888-89, 20 lbs. for 1887-88, and $19\frac{4}{5}$ lbs. for 1886-87. England figures for $73\frac{1}{16}$ lbs., $73\frac{3}{16}$ lbs., and $71\frac{4}{5}$ lbs. respectively. We should expect the proportion per head for 1889-90 to be decidedly higher. The stocks in the United Kingdom still remain 10,000 tons above those of the corresponding period last year.

Present quotations for the standard qualities, as under, are :—

FLOATING.			Last Month.
Porto Rico, fair to good Refining	12/6 to 13/6	against	12/6 to 13/6.
Cuba Centrifugals, 97°/。 polarization	14/3 to 14/6	,,	14/3
Cuba, fair to good Refining	12/9 to 13/3	,,	12/9 to 13/3.
Java, No. 14 to 15 D.S...	14/9 to 15/-	,,	14/9 to 15/0.
British West India, fair brown..	11/6	,,	11/6
Bahia, low to middling brown	10/- to 10/9	,,	10/- to 10/6.
,, Nos. 8 to 9	11/3 to 11/9	,,	11/- to 11/6.
Pernams, regular to superior Americans..	10/9 to 12/6	,,	10/6 to 12/3.

LANDED.			Last Month.
Madras Cane Jaggery..	9/9	against	9/3.
Manila Cebu and Ilo Ilo	9/3	,,	9/-

Paris Loaves. f.o.b...	16/6	against	16/9
Russian Crystals, No. 3, c.i.f.	Still neglected as last month.		
Titlers	18/6	,,	18/6
Tate's Cubes..	20/-	,,	20/-
Beetroot, German, 88%, f.o.b..	12/3 to $12/4\frac{1}{2}$	,,	$11/7\frac{1}{2}$ to 11/9

THE SUGAR CANE.

No. 249. APRIL 1, 1890. Vol. XXII.

☞ The writers alone are responsible for their statements.

Cheques and P.O. Orders to be made payable to The Proprietor, 6, Ward's Buildings, Deansgate, Manchester. All other communications to be addressed to The Editor, at the same address.

For Table of Contents, see page i.

We have given this month several tables of exports and imports, which will be found interesting and valuable for reference as relating to sugar, and also to the general trade of the West Indies more particularly.

Some information respecting the sugar cultivation in India, more especially in the North-West Provinces, which will be found on pages 186 to 189, for which we are indebted to the *Indian Agriculturist*, may usefully be compared with certain references to India in an article on the Comparative Development of Beet and Cane Sugar, translated from the *Sucrerie Indigène* (see page 197).

Besides the large sugar mills at Cossipore, near Calcutta, there are said to be 170 smaller factories in the district, working on the native method. In Jessore, sugar is thus manufactured all over the district. At one manufactory at Kotechandpore, nearly 50 tons of sugar were produced last year. The industry is not now flourishing in Bengal, as the foreign sugars are ousting the native article.

The usual annual meeting of the Fellows of the Royal Colonial Institute was held on the 18th February. The report presented discloses a very satisfactory state of things. The income for 1889 shows an increase of more than £1,100 over that of the preceding year, while a total of 525 resident and non-resident fellows has been elected, as compared with 283 in 1888. At the close of 1889 the membership list comprised 1,303 resident and 2,259 non-resident fellows, or a total of 3,562, of whom eight were honorary fellows and

688 life fellows. The committee recommended alterations in the rules, which would have the effect of limiting the admission to the Institute to British subjects. Since the last annual meeting frequent communications have passed between the committees of the Royal Colonial Institute and of the Imperial Institute, but it has been mutually agreed that further steps relating to the proposed amalgamation of the two bodies should remain in abeyance until the Imperial Institute is in a more advanced condition.

Since the commencement of the year the following estates in Barbados have been sold in Chancery, mostly on re-appraisement:—Vineyard, Halton, Little Diamond, East Lynne, Frere Pilgrim, Saltram, Dayrells, Ellerton, Pleasant Hall, Swans, Mullineux, and the Ivy Estate. See *Sugar Cane* of October, 1889, for a list of Barbados estates in Chancery.

The sugar yield this season in Barbados is said to have reached two hogsheads—and in some places nearly three hogsheads—per acre.

A paper was read in February, before the Agricultural Society of Trinidad, by Dr. Urich, on the Diffusion Process applied to the Sugar Cane, illustrated with simple experiments. At the close a discussion ensued respecting the cost, the saving or otherwise of labour, and the extra yield stated to have been obtained by Mr. Quintin Hogg, in Demerara, and in the Sandwich Islands. The Governor of Trinidad, who was present, in thanking the lecturer on behalf of the Board, used the following words, which we commend to the attention of those interested in the endeavours now being made to introduce the diffusion system:—"I am not a sugar planter myself, but four or five years ago I ventured to express an opinion that the diffusion process would be the process of the future, and I hope that through the efforts of such energetic men as Mr. Quintin Hogg and Mr. Pile we shall very soon see it working in the colony for the benefit of all concerned."

We have been favoured with exact details of the progress hitherto made by Mr. D. Morris, the well-known Assistant-Director of Kew Gardens, with regard to the production of sugar cane from seed. The paragraphs which have been going the round of the press respecting this matter are more or less inaccurate and misleading, and we are therefore glad to be able to furnish our readers with the facts from a

reliable quarter (see page 174). At a late meeting of the Brunswick and Hanover Branch Union of Sugar Manufacturers Dr. Edmund von Lippmann gave some details of the history of sugar which are said to be excerpts from a forthcoming work by him on the subject (see page 200). We have already intimated that, on the doubtful authority of the traveller Bruce, we are informed that in Abyssinia the sugar cane was raised from seed.

The Demerara Argosy is responsible for the statement that the proprietors of the Sangerhäuser Actien-Maschinenfabrik (in Germany) have had information of a deliberate infringement of their patent rights by a prominent sugar estate proprietor in the West Indies. It has been reported that drawings of their machinery slightly modified have been furnished to a Glasgow engineer, who has executed the order. If this should prove to be as it is reported, and there appears to be little doubt that it is so, the patentees are resolved to institute proceedings against the offenders.

On the 30th January last a deputation waited on some members of the Queensland Ministry, asking the Government to appoint a committee to consider the question of the precarious position of the sugar industry, and draw up some scheme by which present and permanent relief might be afforded. Mr. Morehead (Chief Secretary) was of opinion that such a committee would be much more likely to be productive of good if appointed by those personally interested in the matter.

The Queenslander estimates the sugar production of 1889 at 39,150 tons; about 19,000 tons having been exported up to February, there would remain about 7,250 tons more available for export. This is a considerable falling off from the 59,225 tons produced in 1885-86, and it seems time something should be done.

Mr. Claus Spreckels is reported to have expressed the opinion that the reclaimed land in Florida, which he has just been inspecting, is the finest he ever saw for sugar-cane growing, and will produce six tons to the acre without artificial manure.

The attention of those concerned in the question of diffusion *versus* mill, as applied to the cane, is directed to two articles bearing on the subject in the present number. Mr. W. J. Thompson has

recorded his decided opinion that the Des Lignes Plantation has successfully solved the problem of the burning of the diffusion chips as fuel. Unfortunately, we have not space to re-produce his long article on the subject which appeared in the *Louisiana Planter* of February 1st.

The change of ministry in France has somewhat encouraged the French manufacturers, in the hope that the removal of M. Tirard especially, will operate in their favour, against the proposed further modification of the law of 1884.

Preparations are being made at Regensburg, (Bavaria), for the formation of a company for the purpose of constructing a raw sugar manufactory adjacent to the railway between Regensburg and Straubing. The share capital is fixed at 1,000,000 mks., and there is a prospect of securing for the manufactory 3,000—4,000 Bavarian *morgem* of beet.

Many of the Russian sugar factories realised large profits last season. The following are a few of the dividends declared:—

		1890. Per cent.		1889. Per cent.
Sugar Factory.—	Kowalewka......	25	....	25
—	Noskowzy.......	25	....	—
—	Sobolewka......	25	....	17
—	Schtschedrowzy..	25	....	17
—	Tschupahowka...	25	....	25
—	Berschada.......	24	....	?
—	Borowka........	20	....	?
—	Spitschinzy......	20	....	10
Refinery.—	Kiew.................	20	....	11
Sugar Factory.—	Kalnik..........	20	....	?
—	Gonorowka......	18	....	10
—	Gorodok.........	15	....	17½
—	Romanow'sche...	15	....	9
—	Macharinzy......	15	....	10
—	Sitkowzy........	15	....	15
—	Tscharnomin.....	11	....	—

Some, however, paid much less, and a few, none at all. The quantity disposable for export is 1,315,506 poods,—21,140 tons. The total

production is estimated at 24,490,228 poods,—393,590 tons. The exported sugar is sent almost exclusively to Asia.

The Austro-Hungarian beet-sugar manufacturers intend making a show of their products, models of works, machinery, &c. They will probably not give the French manufacturers cause for making any such depreciatory observations as some of them were credited with last year, in regard to the French exhibition.

A new sugar factory is being commenced at Temesvar, in Hungary, which will be ready end of the present year, the refinery belonging to it will not be completed till September, 1891. The Ungarische Zuckerindustrie Geselhschaft has doubled its capital, and is intending to double the capacity of the Szerencs factory, and to erect a new one, making three in all. Another new factory is to be set up at Gerhans, also in Hungary. Finally, another is to be erected at Schottivitz, (Breslau), with a capital of M. 1,000,000, (£50,000).

Dr. E. Fischer is now said to have effected the synthesis of *mannose* and *lœvulose*. We may expect further successes in this direction.

It is reported that the Brazilian exports this season will not reach half the amount at which they were estimated last year, which again was some 100,000 tons behind the preceding one.

Advices from Cuba confirm the idea that the expectations with regard to the large crop which were current a short time back must be considerably modified, and it is possible the production may not exceed that of last year. Owing to the long continued drought the cane was exceedingly dry, and fires have been extraordinary frequent and destructive. According to a telegram last week, one fire alone (on the Constantia estate) destroyed 3,000,000 arrobas of cane.

The diffusion process does not appear to have worked well in the case of the large apparatus mounted by Count Ibanez at enormous expense. The following is taken from the *Havana Weekly Report:*—

THE DIFFUSION PROCESS IN CUBA.

Reports regarding the results obtained which the diffusion apparatus Count Ibanez has established this season on his estates San Joaquin

and Montan are quite contradictory, and have given margin to a sharp controversy in the local papers.

Whilst on one side it is stated that the results thus far obtained are quite inferior as regards both the quality and quantity of the sugar, to those afforded by the mill, the other party positively affirms that the difficulty can be easily overcome, and is altogether dependent upon accidental circumstances.

Be it as it may, the fact is that after one month's trial the working of the battery at San Joaquin was suspended, and Count Ibanez applied once more to the old pression system, whilst the necessary alterations are being made to the diffusion apparatus.

According to recent advices, the working of the apparatus set on the central factory Caracas, at Cienfuegos, that was inaugurated on the 17th ult., is as efficient as can be desired; the cane cutters prepare 200 tons of cane each day, and there has not been the slightest difficulty in loading and unloading the battery; the cane juice is clear and clean, and the Godillot diffusion chip burner is also working as expected it would.

The *Revista de Agricultura* sums up thus:—The results of the present crop will be very much smaller than was expected, considering the extension of the cultivation. Taking all things into account we shall probably have a slightly greater production than that of last year, which was a very short one, and could only be compared with those of 1881 and 1883.

CANE SEED.

The following article appeared in the *Morning Post* of March 11th:—

"West Indian sugar planters have long ago learned to appreciate the indefatigable zeal with which, during his long residence amongst them, Mr. D. Morris, the Assistant Director of Kew Gardens, laboured to promote their interests by the careful study of the botany of the islands and their adaptability for the growth of the productions of other countries. It is in great measure due to his activity in this direction that the West Indies are now rapidly becoming prosperous trading centres for many other commodities besides sugar. It was necessary that something should be done to prevent the utter ruin of the colonists, for within recent years, in consequence of the bounty

system adopted on the Continent, the more cheaply manufactured product of the beet, although of inferior quality, was seriously interfering with the trade in cane sugar, and plantations were found to be so unprofitable that a new source of income had to be found. Since leaving Jamaica, Mr. Morris has evidently not forgotten the supreme importance of the sugar trade to the islands. It was clear, however, that the mode of cultivation in vogue there, as in all other sugar-producing countries, of propagating the crops from cuttings or slips only, could not be looked upon as promising any amelioration of the difficulty. Plants grown from slips are very different from those reared from seeds. In the former case the variety remains unchanged; in the latter, as is well-known to all who take an interest in the most simple garden operations, the seeds of a single plant produce others which vary amongst themselves, and it is by selecting the best seeds that so many beautiful flowers and plants are brought to perfection every year. What it is possible to accomplish by thus selecting what is to be sown is practically shown in the case of the sugar cane's most formidable antagonist. When beet was first cultivated for its sugar it yielded about 7 per cent. of saccharine; now, after careful selection, the product has increased to about 20 per cent. Obviously, therefore, if the cane can be so improved as to yield a largely increased quantity of sugar a step will have been taken which may bring back the trade to its former leading position. But hitherto the obstacle has been that no one has known of the existence of the seed of the sugar-cane, although it has been under cultivation for centuries, and the consequence is that only some three or four kinds of plants are in use. Experiments made recently in Barbados by Professor Harrison and Mr. Bovell, at the Dodd's Botanical Station, show conclusively that the seeds must be hidden in the panicle, for these distributed by the wind have given rise to delicate grass-like plants, about sixty of which, many of them new varieties, have already reached maturity, and further experiments are being made to ascertain whether there is any improvement in the richness of the sugar produced from canes thus grown. The existence of the seed has therefore been abundantly proved, but it has been a long and tedious search to discover actual specimens in the glumes. Mr. Morris has at last successfully accomplished the feat, and on Thursday produced a number of them before the Linnean Society. The mode of germination was described, and young plants a few days old were shown, while at Kew there are specimens already nine

inches high. We have therefore arrived at an interesting stage in the history of sugar cultivation, and judging from the sanguine estimate of the favourable results of cross-fertilisation, a far better time seems to be dawning for the planters than they have experienced for many years. The whole question will depend upon the systematic steps taken to follow up the subject in sugar-producing countries and upon the selection of the most perfect seedling canes, so that we may arrive at the perfection of a sugar yielding plant."

The following is a succinct report of Mr. Morris's work, giving an exact summary of the facts, which are not quite accurately stated in the above leader:—

At a recent meeting of the Scientific Committee of the Royal Horticultural Society, Mr. Morris, Royal Gardens, Kew, in continuation of information placed before the Committee on the 10th December, exhibited specimens of mature seeds of the common sugar cane (*Saccharum officinarum*). There were also shewn germinating seeds, some plants, drawings, and dissections of the fruit (caryopsis) in detail. He stated that there appeared to be no authentic record of any really wild station for the sugar cane. Further, that the fruit of the sugar cane had not hitherto been figured or described. At Barbados, several times during the last twenty years, and more recently by Professor Harrison and Mr. Bovell, self-sown seedlings of the sugar cane had been observed. The subject was taken up systematically in 1888, and about sixty of the seedlings had been raised to mature canes. Many of these exhibited well-marked characteristics differing from the varieties growing near them. Careful enquiry had shewn that canes known as the "Purple Transparent" and "White Transparent," and possibly also the "Bourbon" cane produced seeds in very moderate quantities. Spikelets received at Kew had been examined, and the seed found *in situ*. A description with figures had recently been laid before the Linnean Society by Mr. Morris. It is anticipated that by cross fertilisation and a careful selection of seedlings it will now be possible to raise new and improved varieties of sugar cane, and renew the constitutional vigour of plants that have become deteriorated through continuous cultivation by cuttings or slips. Great importance is attached to the subject in sugar-producing countries, as it opens up an entirely new field of investigation in regard to sugar cane cultivation.

Quantity of Raw Sugar of Domestic Produce Exported from Principal British Possessions (so far as can be stated). From 1874 to 1880.

Possessions.	1874.	1875.‡	1876.	1877.	1878.	1879.	1880.
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
India * (years ended 31st March)	294,818‡	498,054‡	313,554	418,998	366,997	228,713	279,616
Mauritius	1,867,756	1,748,977	2,316,025	2,725,848	2,565,741	2,070,840	2,168,788
Queensland	84,576	48,866	8,880	92,115	67,616	164,319	151,198
Fiji	—	8,064	7,760	9,640	10,965	15,700	11,865
Natal	136,055	155,514	151,482	182,163	148,568	60,201	234,107
Honduras	29,966	46,318	40,349	38,657	34,727	40,053	56,146
West India Islands—							
Bahamas *	13,258	356	6,724	46,728	18,829	3,679	15,269
Jamaica †	582,766	473,399	494,262	519,677	443,125	495,567	546,001
Windward Islands:—							
St. Lucia	119,411	132,436	87,697	95,137	100,776	137,437	119,043
St. Vincent	184,561	207,265	163,825	155,014	154,975	182,434	165,815
Barbados	851,202	1,170,216	681,268	850,689	783,175	1,028,740	975,366
Grenada	75,597	87,455	63,050	55,850	41,929	39,074	33,185
Tobago	46,952	103,106	76,028	65,489	63,432	64,871	66,516
Leeward Islands:—							
Virgin Islands	181	124	73	18	508	145	106
St. Christopher	118,462	147,762	145,355	107,291	195,426	176,059	180,818
Nevis	39,506	61,096	49,916	31,757	28,933	71,550	40,266
Antigua	102,900	246,331	139,359	180,581	180,363	246,905	247,959
Montserrat	34,967	49,477	38,342	27,604	31,599	48,515	22,516
Dominica	65,902	74,446	61,734	57,751	66,404	69,213	65,692
Trinidad	890,531	1,158,939	1,026,082	917,080	1,040,958	1,336,375	1,067,695
British Guiana	1,781,460	1,690,884	2,149,056	2,000,826	1,549,368	1,901,556	1,953,648
Total	7,221,427	8,104,085	8,020,791	8,578,913	7,894,414	8,381,946	8,401,615

Note.—Packages have been converted to cwts. for years prior to 1883 at the following rates:—

	Hhd.	Tierce.	Brl.	Bag.
Jamaica	17	—	—	—
St. Vincent	18	12	$2\frac{1}{4}$	—
Barbados	18	10	2	2
Virgin Islands	15	—	$2\frac{1}{2}$	—
St. Christopher and Nevis	18	12	2	—
Antigua	17	10	2	2
Montserrat	18	13	$2\frac{3}{4}$	2
British Guiana	18	$9\frac{1}{2}$	2	$2\frac{1}{2}$

In other cases the export is stated by weight in the original returns.

* The figures for these Possessions are inclusive of Molasses.

† Years ended 30th September.

‡ Including Refined Sugar.

QUANTITY OF RAW SUGAR OF DOMESTIC PRODUCE EXPORTED from PRINCIPAL BRITISH POSSESSIONS (so far as can be stated.) From 1881 to 1888.

POSSESSIONS.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
India* (years ended 31st March)	515,259	883,483	1,207,424	1,426,827	1,015,596	1,142,598	953,066	1,008,565
Mauritius	2,175,247	2,304,834	2,279,421	2,473,425	2,276,112	2,322,980	1,907,927	2,560,364
Queensland	132,627	116,822	364,412	297,474	604,921	665,184	694,569	452,458
Fiji	13,679	34,622	103,269	174,580	211,729	234,320	256,620	338,311
Natal	171,787	82,818	127,076	235,713	225,808	153,197	177,629	117,748
Honduras	38,610	51,440	40,415	47,835	33,487	14,294	19,051	13,744
West India Islands:—								
Bahamas*	No Export.	18,118	6,251	No Export.	4,467	No Export.	No Export.	2
Jamaica†	357,957	652,674	615,664	558,523	499,718	329,206	460,867	490,480
Windward Islands:—								
St. Lucia	84,654	150,123	152,592	169,416	123,193	85,356	88,564	77,955
St. Vincent	146,485	163,500	185,100	180,846	138,160	89,105	101,777	86,455
Barbados	939,366	966,492	903,168	1,045,332	1,137,530	786,699	1,188,585	1,237,387
Grenada	18,202	29,554	36,995	36,790	11,993	1,541	3,840	1,394
Tobago	72,555	50,358	50,853	75,394	51,946	13,310	46,043	45,072
Leeward Islands:—								
Virgin Islands	40	495	416	122	89	14	123	48
St. Christopher	193,636	249,761	262,833	387,600	288,062	287,780	414,860	390,700
Nevis	40,941	83,515						
Antigua	172,833	253,396	208,719	307,237	265,126	257,148	298,206	315,522
Montserrat	32,614	46,271	33,553	36,264	22,540	28,410	34,054	41,489
Dominica	45,396	68,425	61,807	44,379	51,993	53,756	48,564	39,197
Trinidad	872,153	1,106,533	1,089,917	1,219,221	1,273,584	968,963	1,337,508	1,093,671
British Guiana	1,846,170	2,482,038	2,332,710	2,367,182	1,921,172	2,237,101	2,697,488	2,162,443
Total	7,870,221	9,795,272	10,062,595	11,114,160	10,157,226	9,670,962	10,729,341	10,473,005

* The figures for these Possessions are inclusive of Molasses.

† Years ended 30th September.

WEST INDIES AND BRITISH GUIANA.

Value of Total Exports, from 1874 to 1880, (including Bullion and Specie).

Possessions.	1874.	1875.	1876.	1877.	1878.	1879.	1880.
	£	£	£	£	£	£	£
West India Islands:—							
Bahamas	130,292	108,893	106,836	110,931	142,673	137,120	121,429
Turk's Islands*	24,321	26,364	31,567	22,185	26,910	17,942	27,609
Jamaica†	1,442,080	1,410,485	1,517,015	1,458,669	1,210,705	1,357,572	1,512,979
Windward Islands:—							
St. Lucia	146,858	159,468	143,718	178,735	151,464	210,895	194,694
St. Vincent*	200,546	207,616	183,301	175,379	161,557	160,334	158,947
Barbados*	1,140,767	1,474,910	964,263	1,097,912	1,078,411	1,259,158	1,166,389
Grenada*	158,866	171,332	178,583	145,905	149,208	149,427	171,728
Tobago*	45,387	92,015	79,670	69,058	67,464	70,455	77,615
Leeward Islands:—							
Virgin Islands*	6,889	5,842	4,773	4,804	6,328	5,260	5,147
St. Christopher*	146,143	140,542	156,150	147,164	202,484	176,224	186,012
Nevis*	60,341	57,914	54,683	49,568	30,583	75,875	37,212
Antigua*	106,705	249,677	143,237	210,366	201,177	267,153	263,551
Montserrat*‡	33,079	33,555	28,064	32,056	30,240	35,685	29,121
Dominica*	67,720	71,623	76,948	77,701	84,705	73,667	64,671
Trinidad	1,412,261	1,625,082	1,636,619	2,093,650	1,839,068	2,264,745	2,185,512
Total of West India Islands	5,122,255	5,835,318	5,305,427	5,874,093	5,382,977	6,261,521	6,202,616
British Guiana	2,761,838	2,337,122	3,031,069	3,049,157	2,507,572	2,715,535	2,617,625

* The Exports of Bullion and Specie are not specified in the Returns from these Colonies.

† Years ended 30th September. ‡ Exports of Domestic Produce.

WEST INDIES AND BRITISH GUIANA.

Value of Total Exports, from 1881 to 1888 (including Bullion and Specie).

Possessions.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.
West India Islands:—	£	£	£	£	£	£	£	£
Bahamas	114,100	161,309	147,626	122,351	180,279	150,390	125,464	121,530
Turk's Islands*	25,616	24,895	32,986	34,035	30,853	32,481	26,015	26,027
Jamaica†	1,178,594	1,549,058	1,469,447	1,483,989	1,408,848	1,280,118	1,509,010	1,828,590
Windward Islands:—								
St. Lucia	168,478	222,719	213,823	145,865	121,261	105,207	117,743	122,229
St. Vincent*	141,576	152,530	166,752	116,775	130,342	70,476	85,770	81,836
Barbados*	1,140,361	1,193,295	1,141,134	1,318,879	1,003,894	739,912	1,063,398	1,074,584
Grenada*	194,280	184,221	193,524	213,118	178,721	180,691	217,949	229,263
Tobago*	83,583	48,245	48,036	41,619	38,437	18,891	32,907	38,900
Leeward Islands:—								
Virgin Islands*	5,249	4,966	5,025	3,488	4,917	4,104	4,514	3,472
St. Christopher*	213,080	261,488						
Nevis*	33,672	84,466	252,268	205,497	199,074	159,971	233,821	237,099
Antigua*	178,582	270,846	222,676	177,808	158,980	159,686	152,038	198,961
Montserrat*‡	35,205	38,120	31,494	32,678	16,285	20,944	25,236	27,875
Dominica*	55,163	65,453	63,284	47,288	52,486	51,530	48,106	42,221
Trinidad	2,099,101	2,452,033	2,686,670	2,769,727	2,246,664	2,509,140	1,870,612	2,132,761
Total of West India Islands	5,671,640	6,713,644	6,674,745	6,713,117	5,771,041	5,483,541	5,512,583	6,165,348
British Guiana	2,597,291	3,208,631	3,172,012	2,322,032	1,800,823	1,842,585	2,190,592	2,024,733

* The Exports of Bullion and Specie are not specified in the Returns from these Colonies.

† Years ended 30th September. ‡ Exports of Domestic Produce.

WEST INDIES AND BRITISH GUIANA.

Value of Total Imports from 1875 to 1880 (including Bullion and Specie).

Possessions.	1874.	1875.	1876.	1877.	1878.	1879.	1880.
	£	£	£	£	£	£	£
West Indian Islands:—							
Bahamas	183,993	172,183	153,614	153,667	191,234	164,746	180,815
Turk's Islands	23,773	23,340	23,858	21,790	19,769	21,939	26,206
Jamaica (years ended 30th September)	1,762,817†	1,759,942†	1,700,254†	1,552,339†	1,429,722†	1,347,342†	1,475,197†
Windward Islands:—							
St. Lucia	133,006	150,740	106,963	110,588	108,264	110,472	127,362
St. Vincent *	157,303	152,082	162,023	148,198	150,397	159,433	150,950
Barbados *	1,031,248	1,187,493	1,027,780	1,144,314	1,102,733	1,023,398	1,170,736
Grenada *	106,636	118,385	114,861	127,205	130,686	156,533	138,619
Tobago *	46,435	67,772	54,582	58,750	41,406	37,359	45,138
Leeward Islands:—							
Virgin Islands *	4,377	7,250	2,774	3,856	4,171	8,812	4,268
St. Christopher *	128,811	132,858	139,296	134,225	173,117	177,243	168,027
Nevis *	38,101	23,095	37,933	35,278	32,855	38,813	30,546
Antigua *	146,758	180,363	140,036	176,094	183,795	171,543	160,767
Montserrat	23,958	26,678	23,989	25,471	27,311	26,495	25,364
Dominica *	56,714	62,312	60,918	58,922	65,760	57,502	69,941
Trinidad	1,342,993	1,507,794	1,666,268	1,708,458	1,901,401	2,223,271	2,382,633
Total of West India Islands	5,186,923	5,572,295	5,415,149	5,459,155	5,625,621	5,714,901	6,156,569
British Guiana	1,873,220	1,837,158	1,983,165	2,229,908	2,150,714	2,065,045	2,002,696

* The Imports of Bullion and Specie are not specified in the Returns from these Colonies.
† Imports for consumption.

WEST INDIES AND BRITISH GUIANA.

Value of Total Imports, from 1881 to 1888 (including Bullion and Specie).

Possessions.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.
West India Islands:—	£	£	£	£	£	£	£	£
Bahamas	168,380	216,575	233,144	181,494	235,060	189,410	189,456	190,405
Turk's Islands	27,054	26,822	24,558	26,623	27,858	30,165	26,726	28,268
Jamaica (years ended 30th Sept.)	1,392,669†	1,318,451	1,625,412	1,568,639	1,487,833	1,325,603	1,322,336	1,695,605
Windward Islands:—								
St. Lucia	120,134	133,501	191,191	146,460	93,739	122,283	115,951	140,858
St Vincent*	129,026	152,333	148,286	122,626	101,032	91,185	79,702	79,777
Barbados*	1,119,213	1,162,867	1,155,342	1,156,230	890,690	863,492	983,188	1,058,491
Grenada*	131,985	136,375	135,265	153,421	138,105	120,338	143,185	162,437
Tobago*	59,582	46,927	47,003	33,658	30,758	20,499	23,118	28,847
Leeward Islands:—								
Virgin Islands*	4,999	5,982	7,302	7,239	5,846	3,604	3,039	2,969
St. Christopher*	169,688	188,920	205,788	213,583	152,874	170,735	179,584	173,916
Nevis*	32,799	48,369						
Antigua*	151,883	179,718	183,636	169,501	144,444	131,628	145,229	157,792
Montserrat	25,347	28,781	29,255	25,598	20,636	21,087	30,844	21,359
Dominica*	64,968	72,327	71,330	60,536	50,205	49,734	46,892	49,161
Trinidad	2,226,276	2,399,795	2,663,022	3,083,870	2,241,478	2,503,514	1,918,670	1,943,789
Total of West India Islands	5,823,993	6,117,743	6,720,534	6,949,478	5,620,558	5,643,277	5,207,920	5,733,674
British Guiana	1,784,145	2,099,633	2,224,717	1,999,448	1,467,382	1,436,298	1,603,176	1,586,056

* The Imports of Bullion and Specie are not specified in the Returns from these Colonies.
† Imports for consumption.

WEST INDIES AND BRITISH GUIANA.

Value of Total Exports, from 1874 to 1880, of Gold and Silver Bullion and Specie (as far as can be stated)

Possessions.	1874.	1875.	1876.	1877.	1878.	1879.	1880.
West India Islands:	£	£	£	£	£	£	£
Bahamas	....	....	....	....	....	330	97
Jamaica*	....	....	....	737	660	68,755	65,783
St. Lucia	....	....	....	....	....	....	....
Trinidad	203,633	265,727	339,418	437,382	422,518	494,325	554,217
British Guiana	....	....	....	....	....	300	2,380

WEST INDIES AND BRITISH GUIANA.

Value of Total Exports, from 1881 to 1888, of Gold and Silver Bullion and Specie (as far as can be stated).

Possessions.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.
West India Islands:—	£	£	£	£	£	£	£	£
Bahamas	3,527	489	8,067	....	5,843	8,600	150	160
Jamaica*	54,443	61,725	79,490	106,864	202,987	182,032	155,191	149,321
St. Lucia	....	....	....	....	1,229	....	17,130	9,345
Trinidad	636,340	722,614	927,294	1,188,635	707,421	948,804	216,343	228,569
British Guiana	1,419	3,223	4,369	1,103	3,332	34,644	45,265	64,856

* Years ended 30th September.

WEST INDIES AND BRITISH GUIANA.

Value of Total Imports of Gold and Silver Bullion and Specie (so far as can be stated), from 1874 to 1880.

Possessions.	1874.	1875.	1876.	1877.	1878.	1879.	1880.
West India Islands:—	£	£	£	£	£	£	£
Bahamas	....	....	....	2,395	4,625	4,100	7,538
Turk's Islands	....	....	....	....	....	....	....
Jamaica*	....	....	18,588	9,539	5,698	5,645	210
St. Lucia	....	....	....	....	....	....	....
Montserrat	....	....	....	....	....	....	....
Trinidad	231,311	334,462	418,382	457,813	493,090	498,481	551,184
British Guiana	....	....	....	....	....	15,513	19,938

WEST INDIES AND BRITISH GUIANA.

Value of Total Imports of Gold and Silver Bullion and Specie (so far as can be stated), from 1881 to 1888.

Possessions.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.
West India Islands:—	£	£	£	£	£	£	£	£
Bahamas	2,247	4,565	2,680	6,439	31,876	7,292	....	....
Turk's Islands	100	1,750	160	778	1,349	1,800	....	..
Jamaica*	....	....	103,005	37,112	9,621	31,665	57,074	145,036
St. Lucia	....	....	....	....	....	....	325	3,400
Montserrat	....	....	....	....	200	....	1,500	....
Trinidad	611,188	787,231	969,758	1,251,967	729,164	960,007	271,641	264,817
British Guiana	39,365	24,479	76,358	138,052	6,563	9,821	6,900	18,074

*Year ended 30th September.

SOME RESULTS OF CHEMICAL RESEARCH AS APPLIED TO CANE SUGAR DURING THE SECOND HALF OF 1889.

By DR. EDMUND O. VON LIPPMANN.

In the *Deutsche Zuckerindustrie.*

Andrews has established the following formula for the dependence of rotation on temperature:—

$$\alpha\frac{t}{D} = \alpha\frac{20}{D} - 0{,}000114\ (t - 20)$$

The alteration in rotation for 1° C. of temperature is 0,000171.

Dubrunfaut makes it 0,000232; perhaps because he raised the temperature, not merely as far as 40°, but even as far as 80°, and it is possible that in so doing the differences may increase. According to Kanonikow, the relationship between the angle of rotation α and the angle of refraction ϕ at the minimum of variation is, for equal powers of light,—

$$\alpha = A\ \phi + B.$$

The quotient $\frac{B}{A}$ is, for sugar, 23·52; for lactose, 23·60; for maltose, 23·57; for glucose, 23·60; and is only changed when the dissolving medium is altered, being independent of the nature of the substance dissolved.

According to Bornträger, the optically-inactive sugar of Horsin-Déon resulting from the inversion of cane sugar dissolved in absolute alcohol is simply anhydrous invert-sugar, in the reduction of which the bi-rotation of the glucose at first almost neutralises the rotating power of the lævulose; this effect gradually disappearing, the sinistro-rotative power of the invert-sugar makes its appearance. It is very improbable that any unknown kind of sugar is present in this case; and Guignet's conclusion, based on the fact that glucose precipitates an ammoniacal solution of sulphate of copper, while invert-sugar and lævulose have not that effect, is by no means a proof of such an assertion.

Beythien and Tollens have found that a considerable quantity of lactic acid is produced when sugar is continuously boiled with much lime or strontian, and consequently the acid is present in tolerable quantity (½ per cent.) in the molasses.

INDIAN SUGAR.

From the *Allahabad Pioneer*.

The sugar cane plant, which originally grew wild in India, and is the most valuable of all the tropical grasses, is found to flourish in the western hemisphere only in those countries lying between the parallel of 40° north latitude and a corresponding degree south. Although Bengal, the Native Feudatory States, the North-Western Provinces and Oudh, and the Punjab represent at present, and in the order named, the principal areas of its cultivation, there is scarcely any part of India or Burma in which it is not readily capable of profitable growth, and the acreage under cultivation is consequently found to be annually increasing in area. The main difficulty which is attendant on its cultivation on the continent in India is that of the absence of sufficient natural moisture at the most convenient seasons of the year, which compels resort to artificial irrigation. It is needless to say that this greatly enhances the cost of production. So long, however, as the prices of *goor* and *rab* respectively continue to rise, as has been the case, during the past decade, or even if they are maintained at present rates, the inducements to cultivation will be sufficient to bring about increased production, although it will probably be long ere India, which under her favourable conditions of soil, temperature and labour, might readily supply the world with sugar, will cease to import it for her own use and consumption. Despite all efforts of our Agricultural Bureau, however, the conservative native agriculturist and producer remains practically wholly unaffected and untouched, and appears scarcely influenced by the improved methods brought under his notice, whether in respect to the actual growth of the cane, the expression of the juice, or the preparation therefrom of his raw sugars; for the fully refined product is not attempted elsewhere in India than in the few European establishments.

The native producer who is without the required appliances or knowledge is necessarily himself satisfied with the crude forms of *rab* and *goor*, for which he can usually find a ready sale; whilst the native refiner again aspires no further than to a very partial refinement, in the mere ridding of these raw products of much of their molasses, without attempting any modification of the structure. It is the European refiner alone who develops pure sugar by eliminating all admixture of uncrystallised syrup, and by the more advanced methods now known to science thoroughly purifies it, removing all colour and

other remediable defects which detract alike from its purity and value. Although the term "sugar" is promiscuously applied, outside the trade, to almost every stage and description of the saccharine material, this is far from being correct. "Sugar," as defined by chemistry, is a transparent crystallisable soluble solid composed of oxygen, carbon and hydrogen. Its crystals are anhydrous (*i.e.*, free from the waters of crystallisation), though the first and last constituents (*i.e.*, the oxygen and hydrogen) are contained in water in precisely the same proportions as in sugar. The whole principle of its extraction as true sugar, whether in the higher or lower forms, is based upon its ready solubility in water especially when heated. At the temperature of boiling water it is found to be soluble in almost all proportions. The treatment to which refinement subjects it is consequently to obtain the desired deposit of solid crystals by first reducing the whole mass to a solution by heating it with water, and then again getting rid, by means of careful evaporation, of some of the water so added, which is thus again thrown off from the weak solutions to which the sugar present has been reduced. When what remains is less than what would have sufficed when cold to dissolve all the sugar present, the sugar (which has remained in solution in consequence of the high temperature) commences while cooling to deposit in the form of solid crystals.

It is with the native raw sugars, however, so largely manufactured in these Provinces, that we are for the moment specially concerned, for probably of the methods of their production but little is known beyond the limits of the Agricultural Department. That sugar cane planting has been pursued for a protracted period in the North-West there is ample evidence, nor has any material advance on the old methods of its production apparently been made, otherwise than in the adoption of European mills for expressing the juice of the cane, the one Western invention to which the cultivator of Hindustan has really taken kindly. So far as the seed is concerned, except that the *bhooroonga* and *kewa* varieties mentioned in Martin's *History of Eastern India* (1838) have ceased to be cultivated, all the former descriptions, whether of good canes or others, appear to be still grown, without any attempt to experiment with new seed from Penang, the Mauritius, or elsewhere. It is partly due to this neglect in the selection of seed and to its use in excess quantity in the North-West Province, that whilst the yield of cane reaches in Barbados and Upper Egypt from 30 to 36 tons per acre, and in Demerara from 36 to 40, it does not ever in India attain even half such bulk. Apart from these causes, however,

there are other radical defects, traceable in the exhaustion of the soil by too rapid a rotation of crops and neglect of open fallows; in the absence of the application of dry manures containing phosphates or mineral matters; in late and irregular planting, in careless surface sowing, in defective irrigation (the crop being submerged), and in the exclusion of air and light from the roots; while the crop is too often cut before maturity or too late, when the heat rapidly acidifies the juice. Nor is the expression of the cane comparatively more satisfactorily effected. In the West Indies, up to some 50 to 60 years since, the average of juice extracted represented roughly about the weight of the cane pressed. With improved methods from 70 to 85 per cent. is now attained, whilst India would appear still content with an average of 50 to 55. By the trituration of the ordinary native *kolhu* substances other than the juice, such as vegetable acids, are moreover pressed out in considerable quantities, owing to the breaking up of the fibres: it is probably due to this cause that European mills are finding such favour. Nor is the slovenly, careless method pursued of heating the juice less open to exception. Where sugar, even in solution, is subjected for too long a period to the action of excessive heat, such is its excessive sensitiveness that it becomes gradually changed into a mixture of dark substances, which so far as science as yet discovered are absolutely incapable of crystallisation, and the precise composition of which even yet remains unascertained. When separated finally from the sugar these unreduceable substances take the form of molasses or treacle. How much room for improvement there is yet in these Provinces may be gathered from the fact that, whilst the quantity thus lost is now reduced to a minimum of 2 per cent. in the West Indies, the loss on glucose in the North-West is still about 12 per cent. or 15 maunds of dry sugar to 33⅓ of molasses. Whilst in the returns for the West Indies the weight of the dry sugar on each acre of production is three times as much as that of the molasses, the qualities are reversed in the East and give twice as much molasses as dry sugar.

The courses in dealing with the juice are here two. It is either boiled to a dry consistency, which is clarified by alkalis is called *shakur*, or unclarified is known as *goor;* or it is boiled to a semi-liquid consistency as *rab*, when it is pressed in bags with the feet, developing uncrystallised syrup. The further treatment of this last is to strain it in crates to a substance which when kneaded in the sun by trampling becomes the *kacha chini* of internal commerce. The only further developments of semi-refined sugars in native hands are effected by

boiling in milk and straining. The cane juice is allowed to fall unfiltered into earthen vessels accompanied by cane trash and dirt, whilst from this cause and the cutting of the cane into short lengths, from carelessness, exposure and less of time, it has frequently commenced actively to ferment before even being removed to the boiling pan. It has been found that the native raw sugars exported to Europe from India are generally of so miserable a quality as to prove valueless for refining purposes, and to be only capable of use by brewers. As to quantity, the amount of *rab* expressed per acre is in the North-West roughly about 4,500 lbs., whilst of *goor* the result is less by about 500—a very low average. The average out-turn of dry sugar (Muscovado) in Barbados often exceeds 4 tons per acre. In Singapore and the Straits it is about 3 tons 4 cwt. undrained, to 2·11 dry. The vicinity of Calcutta gives about 1 ton 3 cwt. No one who has witnessed the character of the native operations in these Provinces for the preparation of raw sugars, or who has carefully examined the product itself, but must allow that there is yet considerable room for improvement at almost every stage, from the preparation of the land itself to the ultimate delivery of the raw product to the consumer, and it is difficult to conceive that anything but poverty and the difficulty of obtaining a superior quality would induce even the poorest classes of native purchasers to be content with sugars such as are daily to be seen in active demand in our bazaars.

HOME-GROWN SUGAR IN GREAT BRITAIN AND IRELAND.

A possible new English and Irish Agricultural Industry.

Extracts from a Paper read before the Liverpool Society of Chemical Industry, February 7th, 1890, by Dr. Gustav Schack-Sommer.

In 1879 a select committee of the House of Commons was appointed to enquire into the effects produced upon the home and Colonial sugar industries of this country by what may be called, for the sake of brevity, the bounty system in foreign countries manufacturing sugar for exportation. In the course of his evidence before this committee, Mr. James Duncan was asked if he could give any explanation of the fact that the growth of beetroot was practically confined to the Continent; and if no part of this country was adapted to the growth of beetroot? Mr. Duncan's reply was that it was adapted, but that the disadvantage of growing was owing to the bounty system. Foreign sugar having

a bounty of £2 per ton, which may be taken to be the average, acted as a prevention to the growth of sugar in England. In answer to further questions, Mr. Duncan stated that the bounty rendered it practically impossible to grow any beetroot in this country, though it could be done in the east of England, of quite as good quality, if not better, than even in France.

Mr. George Martineau, giving evidence before the same committee, said that he had given a very considerable amount of attention to the subject of the growth of beetroot in this country. One of the questions asked Mr. Martineau was as to the relative richness of roots grown in England as compared with foreign countries. In answer to this it was stated that Dr. Voelcker, the chemist to the Royal Agricultural Society, found 12 per cent. of sugar in roots from Suffolk; 12½ and 13 per cent. in roots from Berkshire; 11¾ per cent. in roots from Surrey; 10½ to 13¼ per cent. in roots from Yorkshire; and 10, 12, and 13, up to 15 per cent. in roots from Kilkenny. That was in 1870. Since then Mr. Martineau himself had taken a considerable amount of trouble in the matter, and had got roots grown both in Lincolnshire and the Isle of Thanet; and, as far as the latter were concerned, had in his own laboratory, found 15 per cent. of sugar, an amount of richness in which England, in his opinion, could certainly compete with France, where the average was not more than 10½ per cent.

My object, however, in reading this paper is not to repeat evidence given ten years ago before a Select Parliamentary Committee, but to bring before you the results of my own experiments, made last year on the farm of Mr. John Ennis, Springwood, Ballymitty, County Wexford, Ireland; and Mr. John Gibbons, Dunbabin Farm, Wavertree, near Liverpool. I may mention that in Germany and Austria the roots have been grown for years under an artificial system which compels them to be produced of an excessive richness. In this respect Germany surpasses other countries, but from the smallness of the size of the roots there are not so many tons produced to the acre.

Comparison with German roots was possible through the circumstance that Mr. F. O. Licht, of Madgeburg, publishes during the summer months a *résumé* of the results obtained by analysis in his laboratory of a quantity of freshly-drawn beetroots. The days that he did this were always known to me, and on the same day, on several occasions, I had beetroots drawn from the earth both in Ireland and Wavertree, and had them analysed in my laboratory. You will find in the following tables the results of these experiments:—

Date of Experiment	F.O. Licht. Sept. 26th, 1889.	WAVERTREE. Grown at Dunbabin (Marquis of Salisbury's Estate), by Mr. John Gibbons. September 26th.				IRELAND. Grown at Ballymitty, near Wexford, by Mr. John Ennis. September 26th.			
		I.	II.	III.	IV.	I.	II.	III.	IV.
Number of Beetroots drawn for experiment	88	10	10	10	10	10	10	10	10
Average weight with leaves in Grammes	886	918	946	1032	1249	676	762	792	1016
Ditto without leaves ,,	503	358	342	373	539	309	305	368	395
Largest Root with leaves ,,	1650	1400	1285	1505	2075	920	965	1430	1330
Ditto without leaves ,,	1144	401	405	635	624	260	390	690	490
Smallest Root with leaves ,,	482	695	621	640	710	490	625	595	720
Ditto without leaves ,,	275	310	135	216	236	190	275	265	295
Specific Gravity of Juice	1·0781	1·0716	1·0741	1·0744	1·0677	1·0787	1·0828	1·0902	1·0814
Degrees by Brix Saccharometer	18·8	....	..	....	..	....	..	....	..
Quantity of Sugar in 100 parts	16·22	15·0	15·6	14·7	14·2	16·7	17·	18·2	16·8
Ditto Non-Sugar ,,	2·58	....	..	....	..	....	..	....	..
Quotient ,,	86·2	....	..	....	..	....	..	....	..
Per Cent. shown by Fehling's Solution	....	·5	·4	·4	·4	·5	·5	·6	·5

1 Kilogramme (1,000 Grammes) equals about 2lbs. English weight.

	F.O. Licht.	WAVERTREE. Grown at Dunbabin (Marquis of Salisbury's Estate), by Mr. John Gibbons. October 10th.				IRELAND. Grown at Ballymitty, near Wexford, by Mr. John Ennis. October 10th.			
Date of Experiment	October 10th, 1889.	I.	II.	III.	IV.	I.	II.	III.	IV.
Number of Beetroots drawn for experiment	112	10	10	10	10	10	10	10	10
Average weight with leaves in Grammes	900	675	958	967	1268	1079	1118	1177	1077
Ditto without leaves ,,	540	246	364	404	429	506	469	460	479
Largest Root with leaves ,,	1670	800	1260	1330	2215	1440	2040	1500	1650
Ditto without leaves ,,	1205	370	340	340	570	660	720	570	710
Smallest Root with leaves ,,	490	400	590	510	770	780	820	780	740
Ditto without leaves ,,	295	130	255	200	310	380	320	310	330
Specific Gravity of Juice	1·0806	1·0799	1·0799	1·0784	1·0793	1·0867	1·0838	1·0821	1·0888
Degrees by Brix Saccharometer	19·4	18·7	18·7	18·3	18·4	19·9	19·8	19·6	19·9
Quantity of Sugar in 100 parts	16·58	16·5	17·	16·7	16·4	18·2	17·5	17·2	18·8
Ditto Non-Sugar ,,	2·82	2·2	1·7	1·6	2·	1·7	2·3	2·4	1·1
Quotient ,,	85·5	88·2	90·9	91·2	89·1	91·5	88·4	87·8	94·6
Per Cent. shown by Fehling's Solution	....	·3	·4	·5	·4	·5	·7	·5	·4

1 Kilogramme (1,000 Grammes) equals about 2lbs. English weight.

Some people imagine that beetroot is an exhausting crop. On this point Mr. George Martineau gave very conclusive evidence before the Select Committee already mentioned, as having been held in 1879. He quoted Mr. John Algernon Clarke, secretary to the Central Chamber of Agriculture, and Dr. Voelcker, chemist to the Royal Agricultural Society, to the effect that it is not an exhausting crop, and that it is one very favourable to the growth of wheat, the deep cultivation necessary to grow beetroot increasing the production per acre of following crops.

As a proof that soil is improved by the cultivation of beetroot, and the extra tilling and manuring which such cultivation entails, I may mention the case of an estate called Groena, in the Dukedom of Anhalt, which comprises about 700 or 800 acres of fertile land. The owners did not plant any beetroot before 1837, and then up to 1853 only a few acres for a trial. In 1853, however, they began to plant about 150 acres every year, and in 1856 the results proved conclusively that they had got as much corn as they had formerly done when the whole area of the estate was devoted to its cultivation. On another estate, that of Ossnarsleben, near Bernburg, after having introduced sugar beetroot growing, there was an increase of about 2 per cent. in the corn crop. In France, in the Arrondissement of Valenciennes, not only was the corn crop increased by the introduction of beetroot, but they were able to feed 11,500 head of cattle instead of 700. The conclusion to which these facts point is obvious. Beetroot, so far from being an exhausting crop, positively enriches the soil if it is planted with a due regard to rotation. That is to say, if some years are allowed to elapse before the planting is repeated, it is not only a paying crop in itself, apart from the question of the value of its fibre as food for cattle, but it positively increases the fertility of the ground for wheat or other cereal production.

The points to be borne in mind in connection with what has been already said may be thus summarised:—(1) That sugar beetroot grows in any soil, if it is rich in soluble mineral ingredients, and has nothing of pipeclay or sand in its composition; (2) that sugar beetroot requires a soil with a deep foundation, and one that is very equal in its layers; (3) that the ground ought to be well drained, or to drain itself well; (4) that water is a necessity, but that water in excess is injurious to beetroot cultivation; and (5) that it is impossible to plant beetroot profitably oftener than every fourth year.

So far I have only spoken of the cultivation of beetroot from an agricultural point of view; but I have no doubt it will be equally interesting to those who regard the question as a purely financial one.

On this point I may be permitted to quote from a publication which is, no doubt, known to most of you, viz., *The Sugar Cane.* [Instead of reproducing the paragraph we think it more practical to refer the reader to our monthly reports of the results obtained in Germany, Belgium, &c.]

I have nothing more to add except to point out the immense advantages that would accrue to agriculturists both in England and Ireland from the cultivation of beetroot as an alternate crop. The evidence given before the Select Parliamentary Committee in 1879, especially by Mr. George Martineau, points clearly to the conclusion that, but for the existence of foreign bounties, beetroot, for the manufacture of sugar, might be profitably grown both in England and Ireland; profitably, not only in the certainty of producing a valuable crop, but also in enriching and fertilising the soil, and, at the same time, providing the cheapest and most useful form of food for cattle. These points, let me remind you, are not mere matters of individual opinion, either of mine or of anybody else. They are facts, the truth of which, as I have endeavoured to show, I have proved by my own experiments and experience; facts which have also been demonstrated in an even more conclusive way by the Continental examples already quoted. That the cultivation of beetroot would be a good thing for England, and an especially good thing for Ireland, I hope that what has been already said has done something, at least, to prove.

[On the conclusion of the paper, a number of interesting queries were put.]

Dr. Schack-Sommer, in replying, said he should begin by answering the remarks of the last speaker. Of course there could be no prospect of the farmer getting rid of his beetroot until works were erected for the purpose of preparing the beetroot for sugar manufacturing On the Continent generally, where beetroot is grown, a certain number of farmers in each district club together and build a factory, each farmer undertaking to deliver to the factory a certain weight of beetroot during the season. The factories are run on this principle, and after the owner's contract quantity is worked up they buy further quantities in the open market if they deem it advisable, and by their system each factory is secured a minimum quantity at a stipulated

price each season. As a rule the several factories are connected each with separate estates, and they are built in such situations as will afford the best facilities to the growers for delivering their produce. With respect to the probable profit of beet growing, which Mr. Carey and three other gentlemen referred to, Dr. Schack-Sommer said he had prepared a tabular statement, which gave some interesting particulars, and which he presented.

He found from good authority the cost of planting and working of sugar beetroot, including delivery at the works, rather over than understated by several British farmers.

AMOUNT REALISED.

(Taking English measures and weights.)

	£	s.	d.
1. 33,070 lb. Beetroot at 1s. 1d. per cwt.	15	19	10
2. 35 per cent. Residue for Feeding Cattle, 11,574 lb., at $3\frac{1}{2}$d. per cwt.	1	10	2
3. 8,250 lb. Leaves and Roots, at 3d. per cwt.	0	18	6
	£18	8	6
Expense of working, or all and every expense included ..	12	13	0
Net profit per Acre to Farmer	£5	15	6

COST OF GROWING, &c.	£	s.	d.
Topping stubble	0	6	0
Twice harrowing	0	3	0
Deep ploughing with four horses or steam	1	2	0
Twice harrowing in spring	0	2	0
Artificial manure	2	10	0
Drilling, harrowing, drilling, and rolling	0	12	0
Hoeing and weeding	0	2	0
33 lb. of beetroot seed at $3\frac{6}{7}$d. per lb.	0	10	6
Horse-hoed or drilled three times	0	6	0
Hoed by hand twice	0	9	0
Thinning..	0	5	0
Getting up roots and trimming and washing	1	0	0
Sending roots to works	1	16	0
Making silos	0	1	6
*Rent	2	10	0
*Ground dues and taxes	0	18	0
	£12	13	0

From this table it would be seen that the cost of production per acre was about £12 13s., and as the produce brought in the market

* Of course both these items are extremely high for England.

about £18 18s. 6d., there would be a profit of £5 15s. 6d. per acre for the grower.

The question was asked, if the present year had not been an exceptionally good one for beetroot growing, to which Dr. Schack-Sommer replied that his comparisons were made, of course, with roots grown during the same season, and therefore under similar climatic conditions; but, speaking generally, the saccharine yield in 1889 was by no means abnormal nor equal to the highest of recent years, since the saccharine yield in 1888 was over 13 per cent., whilst in 1889 the average was under 12 per cent. The weight of roots per acre, however, in 1889 was much heavier than in 1888, a circumstance which may be attributed to the extremely favourable conditions under which the beet was sown in 1889. Beet should be sown as early as possible in the month of April, while the ground contains a large amount of moisture. Dr. Schack-Sommer stated that the experimental seeds were procured for him by Professor Scheibler, who had selected them from the best source in Germany. They were of four different kinds, and were, of course, distinguished by different German names.

With regard to the question of climate. Climate, of course, affected the roots materially, but the experimental roots had been grown in Wavertree and Ireland, under the most unfavourable conditions, when the soil was not specially prepared for their growth, and the latter part of the season was cold and wet, yet the yield from the roots compared most favourably with the best roots grown in Germany. It must be admitted that the experiment showed most indubitably that the climates of England and Ireland were highly favourable to the growth of sugar-beets.

PROFITS OF SUGAR REFINING IN THE STATES.

An analysis of the sugar refining business of this country for the past two years, prepared by Messrs. Willett & Gray, 91, Wall Street, New York, gives the average profit on refining as $\frac{5}{8}$c. per pound on a total consumption for the two years of 2,896,965 tons, of which the Sugar Trust refined 1,850,875 tons, and the non-trust companies refined 822,281 tons, while 223,809 tons were consumed without refining. The total profits of the Trust for the two years were about $26,000,000, and of the non-trust refineries $11,500,000.

There were twenty corporations taken into the Trust with capacity

of 32,300 barrels daily, but these are now reduced to virtually ten motive powers with capacity of 28,500 barrels daily, only 20,143 barrels of which was used in 1889. The outside refineries have a capacity of 13,900 since the completion of the Spreckels refinery in Philadelphia. About 10,400 barrels daily were produced during the year.

The net value of the Trust refineries on the basis of the cost of the recently built refineries, it is stated, should not be less than $15,000,000, exclusive of cash assets and materials and earning capacity. The recent price of $50, Willett & Gray say, was below their net intrinsic value if liquidated. Their figures show a surplus of $17,000,000 on January 1st, 1890. It is estimated that $3,000,000 was expended for improvements.—*Merchants' Review*.

THE COMPARATIVE DEVELOPMENT OF BEET AND CANE SUGAR PRODUCTION.

With Remarks on Indian Sugar.

From the *Sucrerie Indigène*.

Seven years ago the European production of beet sugar and the production of cane sugar in other parts of the world balanced each other within a few thousand tons, leaving out of the question the cane sugar which does not usually come into the trade of Europe or the United States, or which only figures accidentally in those markets, such as the sugars of India, China, Formosa, &c.

Last year the production of beet sugar exceeded that of cane sugar by about 500,000 tons. This year, or this campaign, the difference will be much more marked; according to present estimates, it will considerably exceed a million of tons in favour of the beet sugar. The following table, in round figures, makes these facts clear:—

	Beet Sugar. Tons.	Cane Sugar. Tons.	Totals. Tons.
1883-84	2,361,000	2,323,000	4,684,000
1884-85	2,546,000	2,351,000	4,897,000
1885-86	2,220,000	2,340,000	4,560,000
1886-87	2,730,000	2,345,000	5,075,000
1887-88	2,452,000	2,470,000	4,922,000
1888-89	2,765,000	2,280,000	5,045,000
1889-90	3,500,000	2,278,000	5,778,000

We see that during the period under consideration the production of cane sugar has remained stationary, or even diminished, while the production of beet sugar has progressed enormously.

In the beet sugar producing countries the raw material, the industrial appliances, and the methods of manufacture, have been steadily improved, at the cost of great sacrifices, and the quantity of sugar has been regularly increased. In the cane sugar producing countries some progress has also been made in these respects, but no serious attempt has been made in this direction, except when a decline in prices had brought on a crisis, that is, when the means of working, money and credit, began to fail.

In extra-European countries the development of the European production is attributed more especially to the premiums granted by the Treasury in most continental countries, either to raw or refined sugar, or both. The premiums have certainly played their part in the extension of the annual production of beet sugar; but there are cane sugar producing countries where the premium is more than treble what it is in Europe, and in which the production has none the less remained stationary. Louisiana, for example, is a country especially privileged in the matter of premiums; it enjoys an enormous advantage from fiscal assistance, equivalent to the customs duties, which are more than 20frs. per 100 kilos. of 88° sugar (8s. per cwt.); in spite of this, the annual production of that country remains somewhere about 150,000 tons; and Brazil, notwithstanding the subsidies granted to her sugar works, does not succeed in developing its production, which in 1883-84 was 360,000 tons, and has never since reached that figure. Guadeloupe and Martinique, which concern us more nearly, and which have for some years had the advantage of the premiums granted in the mother country, are in the same position; their crop of 1883-84 has never yet been surpassed by any of the six succeeding crops.

It is the yield of sugar obtained, and the consequent reduction of the cost price, which constitutes the superiority of the European sugar manufacturer. In Europe the improvement in the cultivation and manufacture has been earlier and more rapid than in the colonies.

We must not, however, repose upon our laurels. On this continent we have reached almost the last rung of the ladder as regards the yield obtainable; in the cane producing countries there is still plenty to be done in this respect, and the position would undoubtedly be

reversed, as far as we are concerned, if once those countries had attained all the progress in respect of cultivation and manufacture of which they are capable.

The extra-European countries which are making most efforts to develop their sugar production are those of North America. As yet Canada has not succeeded in creating a beet sugar industry, but some very encouraging results have been obtained in the United States. Whilst sorghum has proved deceptive, and the Louisiana production has remained almost stationary, it would seem as if they were in a fair way to attain greater success with beet sugar.

If we may believe the papers, California has two sugar factories at work, and others are about to be erected.

Some years ago a grand future was predicted for the sugar industry in Australia. Those hopes have not been realised; the production of that country appears rather to be falling off. At any rate, the Mauritius sugars seem still to find a good opening in the populous centres of Australia. It is said that frequent and occasionally intense frosts present a serious obstacle to the cultivation of the cane in that country.

There are other countries in which the production of sugar has been declining for some years. Natal, for instance, is said now only to possess one factory in work. At certain intervals there are night frosts, whilst the heat at other times is great, and there is a want of moisture; irrigation is difficult and costly, and the cost of labour since the discovery of numerous mines, is out of proportion to the price of sugar. It is only rarely that Natal sugar is now seen in the London market.

In conclusion, it may not be uninteresting to speak of India which is generally thought to be in a position to export to Europe and the United States more or less considerable quantities of sugar, when prices are at a high level. As we mentioned at the outset, the Indian production is not included in the table we have given. This great country exports very little sugar, at any rate, according to calculations made, it imports as much as it exports.

The exports consists of low grade sugars; on the contrary, the imports included crystallised sugar from Mauritius, and refined sugar from Europe, products which are in request among the well-to-do population, whilst the poorer inhabitants content themselves with the grey and brown sugars produced by the small native planters. Of late years especially, India has sent but little sugar to

Europe and the United States. On the other hand, she has imported large quantities from Mauritius through Bombay and Calcutta. The Mauritius sugar is in especial favour; a few years ago the Mauritians got over one of the priests, accompanied by a commission, in order to prove to him, in the works themselves, that the Mauritius manufacturers do not use animal (or bone) black in the preparation of sugar. A religious prejudice forbids the Hindoos to use articles in the preparation of which animal substances like bone black are employed. Since then, the Mauritius sugar has regained the esteem which it had momentarily lost owing to the interested and unscrupulous remarks of competitors residing in India.

The Indian production is estimated by the Government at 2,500,000 tons. It has not increased during the last few years. Famines have raised the price of wheat and rice; the cultivation of cereals having become more remunerative, has partially replaced that of the sugar cane.

On the other hand, the native sugars have found new markets owing to the opening up of railways and routes in the direction of China and Central Asia. These new openings and the low prices of sugar in Europe have operated to prevent the latter receiving any considerable supplies from India. Such is at any rate the opinion of one who is in a position to obtain good information on Indian matters, and who has a special interest in knowing the state of the sugar trade of that country.

THE HISTORY OF SUGAR.

Dr. Edmund von Lippman, the distinguished German chemist, is about to publish a historical account of sugar from the most ancient times down to the beginning of the beet sugar manufacture. At the last meeting of the Brunswick and Hanover Branch Union of Sugar Manufacturers he read a paper, which he expressed a wish should not be published, as it consisted mainly of extracts from his forthcoming work. The *Deutsche Zuckerindustrie* has, however, apparently been permitted to give a short résumé of the lecture, of which we therefore present a translation, as it cannot fail to be of interest, coming from so eminent an authority on sugar matters. The résumé is as follows:—

The original home of the sugar cane must be looked for in the coast regions extending from Bengal to Assam, at the northern extremity of the Bay of Bengal. It is remarkable that there is now no such thing as wild sugar cane, whilst four-fifths of other formerly

wild but now cultivated plants are still in existence in a wild state. Not the slightest chronological indication as regards the time when it was first known is to be found in the Indian annals; a Chinese compilation of the third century states that the province of Bengal sent sugar cane as tribute to China, from which we may conclude that at that time solid sugar was not known. The first indication of sugar itself is found between the third and the sixth century in India, while the Chinese were not acquainted with its manufacture until about the year 640. In the ninth century clarified sugar was prepared by drying the raw sugar in the sun. The companions of Alexander the Great speak of a sort of honey which they met with on the way to Asia, which grew there without bees. At the commencement of the sixth century there was sugar cane on this side the Indus at the confluence of the Euphrates and Tigris. The conical shape of the sugar loaf has existed since the seventh or eighth century. The refining was effected chiefly by the use of the ashes of plants. Sugar came first into Europe at the time of the conquest of Sicily by the Saracens in 827. From Morocco the manufacture of sugar extended to Spain, and attained such a development that it amounted to 100,000 tons per annum. In the year 990 the Doge Orseolo concluded the first treaty of commerce with the Arabs, and refined sugar was then first introduced into Venice. From thence sugar found its way to Germany, and is first mentioned in the poems of Wolfram of Eschenbach, and Gottfried of Strassburg. Columbus took the sugar cane with him on his second voyage to America, but it appears to have been again lost sight of there. In Germany the first refinery was established in 1573, at Augsburg, by the patrician family of Roth; the next refinery was set up in 1597 at Dresden.

The only reliable bases for calculating the prices of sugar are to be found in England. In London the price of a cwt. of white sugar, calculated according to the present value of money, was as follows:—

From	1200 to 1350	(average)	625	marks.*
,,	1351 ,, 1400	,,	949	,,
,,	1401 ,, 1540	,,	600	,,
,,	1541 ,, 1582	,,	322	,,
,,	1583 ,, 1702	,,	423	,,

Between 1702 and 1800 the price fell to 120 marks. During the time the continental ports were closed the cost of sugar in Hamburg was 100 thaler (£15) per cwt.

* German marks = English shillings.

THE CANE SUGAR INDUSTRY IN LOUISIANA.

Mr. J. B. Wilkinson, jun., of New Orleans, associate editor of *The Item* newspaper of that city, last year published a pamphlet on the results of the Diffusion Process of Louisiana and Texas. This met with considerable approval, and he has now decided to issue an annual summary of his observations under the name of "Wilkinson's Report." We have received the first number,* which gives a succinct account of the results of the Louisiana sugar harvest of 1889-90.

We have perused this pamphlet of over 100 pages with interest, and advise those who would be thoroughly posted up in the various items connected with the work done last season on the principal Louisiana plantations to obtain the small volume. It is preceded by a short history of the Diffusion Process in America (which we here give in condensed form), after which follows a detailed account of each plantation, the machinery in use, the mode of proceeding adopted, and the results obtained in each case. Of each of these we give a very brief notice so as to enable our readers to form an estimate of the book.

The History of Diffusion.

Diffusion was introduced in Europe less than twenty-five years ago. A few years later the process was adopted by the cane sugar factory at Aska, India, but this battery had wooden tops and bottoms and was altogether too primitive to prove a financial success.

America is generally in advance and rarely far behind the rest of the world, and in 1873, Mr. R. Sieg, of New Orleans, with a number of friends in this city and Europe, raised the capital necessary to purchase a diffusion plant. A contract was made with the inventor of the process, Mr. Julius Robert, for the construction of an apparatus under his immediate supervision. The battery was built in Austria, and reached here late in the season. It was at once erected on Messrs. E. and J. Kock's Belle Alliance plantation in Assumption parish, but notwithstanding every exertion to hasten the work, the battery was not ready for operation until December 18, 1873. In the meantime the cane had been frost-bitten twice and was windrowed on November 28. It was in such bad condition that one-third of it had to be cut off and left in the field. Forty arpents of cane, giving 500 tons, was worked up by diffusion, the experiment ending on January

* Wilkinson's Report: Diffusion and Mill Work in the Louisiana Sugar Harvest of 1889-90. By J. B. Wilkinson, jun. Brandas and Gill, New Orleans. Price 50 cents.

3, 1874. The juice weighed 6·60 Beaume. 84·39 pounds of normal juice was obtained from 100 pounds of cane. The best result obtained from the mill had been 66 per cent. extraction. From the clarifiers the juice went through five open kettles and to an inferior vacuum pan. The yield was 35,736 pounds of first sugar and 66,504 pounds of molasses.

This trial showed the mechanical defects in the machine, which was constructed on the plan of the apparatus at Aska, where labour is five cents a day, and labour-saving devices of little or no importance. The emptying of one cell took four to six men from one-half to three-quarters of an hour, and the filling could not be done in less than twenty-five minutes.

The gentlemen who had embarked in the undertaking now formed a chartered company under the name of the Julius Robert Diffusion Company, and contracted for the erection of a complete apparatus at Belle Alliance. In case of success, the apparatus to be taken by the plantation at cost price with an annual payment of a royalty on the surplus gained by diffusion. In the event of failure, the apparatus to be removed at the expense of the Company. They contracted to erect an apparatus for Mr. E. C. Palmer, of Southwood, on similar conditions.

New batteries and cutters were designed and erected on the two places. Under the new system a cell was filled in 13½ minutes, and discharged in from four to six, only three men being employed for both operations.

At Belle Alliance the mill started October 12, 1874, and the battery two weeks later. The first run by diffusion lasted four days and the second five days, showing a net surplus over the mill of 43 per cent. on sugar and 35·93 on molasses. For several weeks the diffusion battery alternated with the mill and seems to have maintained a superiority of more than 40 per cent. But the open kettles and small vacuum pan did not possess sufficient evaporating capacity, and Mr. Kock appears to have given the preference to the mill. The maximum diffusion product was about 160 pounds of sugar per ton of cane, which was pretty good for diffusion juice evaporated in open kettles.

Diffusion at Southwood was a failure for the simple reason that the only evaporating apparatus from juice to masse cuite was a train of open kettles, and the sugar in the coolers failed to crystalize rapidly enough for practical purposes.

To give an idea of the first apparatus, it may be stated that the cane was elevated to the upper floor in a four story building, whence it was fed by hand to cutters on the third floor. On the second floor was the diffusion room, and on the first the diffusion vessels. While the improvements devised were a great advance, the apparatus would by no means compare favourably with the modern type now erected in Louisiana.

Finding that diffusion could not be made financially successful in connection with open kettles, a plant equipped with two Roberts double effects was erected on Louisa Plantation. But this plantation, not then filled up by the light soil deposited by the Davis crevasse, was one of the poorest places in the State, and the crops were small. A good deal of cane was purchased and transported to the factory in flatboats. But difficulties and delays in transportation and inclement seasons furnished a chapter of accidents, that, added to the defects in the apparatus, brought this last of the early experiments with the new process to a disastrous conclusion.

Disheartened by failure, the advocates of diffusion lost hope if not faith, and little interest was manifested in Louisiana in regard to the new process until 1885, when the subject began again to be discussed. Mr. Wilkinson then, in repeated articles, advocated the erection by the Government of a diffusion battery in this State, thinking it to the interest of the sugar industry that there should be a crucial test in order to arrive at a definite conclusion one way or the other.

Dr. H. W. Wiley, Chief Chemist of the Department of Agriculture, learned, from a costly experience at Ottawa, Kansas, that the style of battery used in Germany for beets would not do for sorghum or cane. In the battery erected at Fort Scott in 1886, previous difficulties were overcome, and in October of that year a successful experiment was made on 140 tons of Louisiana cane, sent through the instrumentality of *The Item* to Fort Scott. With the light of this experiment to guide him, Dr. Wiley, in 1887, erected the apparatus at Magnolia.

Magnolia.

The apparatus erected by Dr. Wiley at Magnolia in 1887 consisted of 14 cells built by Colwell & Co., of New York, and a horizontal disc cutter from the Sangerhausen Company, of Germany. It was late in the season before the machinery was in good working order, and

only one complete experiment was made. This, however, gave the following result:—

Cane Ground	199·2	tons.
Average sucrose	14·	per cent.
Average glucose	·49	
Coefficient of purity	86·05	
Exhausted chips, sucrose	·8	
Extraction, per cent. sucrose	94·5	
Polarization, first sugar	98·9	
First sugar per ton of cane	165·	
Second sugar per ton of cane	45·9	
Third sugar per ton of cane	18·6	
Total sugar	230·	pounds.

In 1888 Governor Warmoth had the battery enlarged, the capacity of the cells and heaters being increased by about 50 per cent.

The following report of the crop of 1889, is by Dr. G. L. Spencer, Chemist of the Department of Agriculture:—

Total weight of cane worked, tons	7,443·9
,, ,, 1st sugar, pounds	1,107,117
,, ,, 2nd sugar, pounds	325,086
,, ,, 3rd sugar, pounds	154,000
,, ,, all sugars, pounds	1,586,203
1st sugar per ton of cane, pounds	148·73
2nd ,, ,, ,, ,,	43·67
3rd ,, ,, ,, ,,	20·69
Total sugar, per ton of cane, pounds	213·09
1st sugar per cent. cane	7·436
2nd ,, ,,	2·184
3rd ,, ,,	1·034
Total sugar per cent. cane	10·654
Average normal juices per cent. sucrose	12·73
,, ,, ,, glucose	·96
,, diffusion juices per cent. sucrose	9·18
,, ,, ,, glucose	·62

Mean data are proportioned to the work done each day, a sample being taken from each diffuser.

Average polarization of sugars	93·
Available sucrose extracted, lbs. per ton of cane	203·3
Available sugar (93° polarization) extracted, lbs. per ton of cane	218·6
Extraction, in terms of the normal juice, per cent. cane	85·9
Sucrose left in exhausted chips, per cent......	·66
Mean dilution, per cent.	39·7

The dilution is based on the sum of the sugars in each juice, and includes the water used in washing out the last of the sugar preparatory to emptying the battery. Seventy extra "draws" were made for this purpose during the season.

Coal consumed for entire crop, pounds........	2,039,295
,, ,, per 1000 lbs. of sugar, lbs.	1,285
,, ,, ,, ,, ,, barrels..	7·14

Taking the last 29 days of the season, during which time an average of 200 tons of cane per day was worked, the coal consumption was 6·33 barrels of 180 lbs. each, per 1,000 lbs. of sugar.

The cane was as inferior in quality as in quantity, showing 12·73 sucrose and ·96 glucose against 14·1 sucrose and ·56 glucose in 1888. In the best run the available sugar at 93° polarization, calculated at sucrose less glucose was only 224·9 pounds of sugar per ton of cane.

An average yield of 213 lbs. of sugar per ton of cane is therefore a splendid result and gives Magnolia the medal for 1889.

(To be continued.)

THE MANCHESTER SHIP CANAL.

A lecture was delivered on the 19th March on the above subject by Alderman W. H. Bailey, of the firm of W. H. Bailey & Co., Limited, Manufacturing Engineers, Salford, ex-president of the Manchester Association of Engineers, the Mayor presiding.

Although we have not room to insert this exceedingly interesting and practical paper at full length, as we should have liked to do, we willingly extract the following particulars:—

The Manchester Ship Canal is thirty-five miles long. It commences in deep water at Eastham, on the Cheshire side of the river Mersey, which is about one-and-a-half miles wide at this point, and is semi-

tidal two-thirds of its entire length to Latchford. With the exception of about four miles the river Irwell is canalized to Manchester.

	Feet.
The minimum width of canal at bottom..............	120
And the average width of canal at water level........	172
The bottom width of canal between Barton and Manchester (2½ miles) is increased to	170
Minimum depth	26

The Suez Canal is 75 feet wide and 26 feet deep.

The Amsterdam Canal is 88 feet wide and 25 feet deep.

There are 44,000,000 cubic yards of excavation of soil and rock to be removed in 48 months. Up to the present time, satisfactory progress has been made, about 30,000,000 cubic yards having been excavated. There are 97 steam navvies, with their huge buckets, taking out from the cuttings thousands of tons per day. At a reasonable calculation, one machine alone was doing the work of 2,000 men. There are 169 locomotives, 245 steam cranes, 130 portable and other steam engines, 211 steam pumps, 6,160 wagons, 52 pile-driving engines, and the overland route of railway and sidings is 220 miles long. The steam power employed may be roughly estimated at about 50,000 horse-power. There are 169 horses, and over 12,000 men and boys. 10,000 tons of coal and 8,000 tons of cement are used per month. The Manchester Ship Canal is in effect a continuous dock system, 35 miles long, taken from one end to the other. It is the nearest port accommodation for large ocean steamers for a population of 7½ millions. Within six miles of the Manchester Exchange, there is a population of 1,000,000; within twelve miles, a population of 2,000,000; and within twenty-five miles, the largest population of the world, not including Pekin or London.

The Canal will be finished in the time. So far everything has gone well with this great public enterprise. There are twenty-one months in which to finish the Canal, and we have faith that it will be completed according to contract. Manchester has a reputation. In "Coningsby," Disraeli says, "The age of ruins is past; have you been to Manchester?" It seems but a natural sequence, in this birthplace of the last discovered law of force, which declares the rate of exchange between heat and energy; in the city whose illustrious son, Dr. Joule, has taught mankind how to measure, weigh, and value heat and mechanical motion, that some consideration should have been given

to the economics of trade, and to the removal of those obstacles which impede commercial progress.

In that great text book of Adam Smith's, "An Enquiry into the Causes of the Wealth of Nations," he directed attention to the folly of expecting an increase of public prosperity by making foreign commodities dear by force of law.

"Civilisation is the economy of force," the preception and acceptance of this doctrine is a measure of intellectual progress. The men, and the sons of the men, who worked in past times for the removal of the restrictions on commerce, are the men who are making the Manchester Ship Canal.

DIFFUSION *v.* CRUSHING;

WHICH IS THE MOST PROFITABLE?

A discussion of the above question (referred to in our March number) by the Louisiana Sugar Planters' Association took place on the 13th February last. It was proposed to continue the subject at the next meeting of the Association, to be held on the 13th March, so that the question cannot yet be considered as disposed of, and we are, therefore, compelled to reserve until next month the *resumé* which we had intended to give. Meanwhile *The Louisiana Planter* has an article which summarises the results of the discussion already held, at which several papers were read, and the experience of some of the leading proprietors of estates where the diffusion process is in use was related, compared, and criticised. We therefore gladly avail ourselves of this article (in a condensed form, omitting certain statements and inferences in favour of the diffusion system to which we are not yet quite ready to subscribe) to put the subject before our readers as far as the discussion has hitherto proceeded. We also add (from the same journal) a paper, read by Mr. Adolph Seeliger at the meeting, which has the merit of being brief and practical, and may advantageously be compared with the results given in our notice of "Wilkinson's Report" on page 202.

The editor of *The Louisiana Planter*, after informing us that papers are expected to be read at the next meeting by Governor Warmoth and Dr. Stubbs (both well-known leading men), goes on to say:—

It appears to have been the unanimous sense of the last meeting, so far as this was expressed at all, that, in product secured from like canes, diffusion indicates an average advantage of about 12½ per cent. over the best milling yet accomplished. It need not matter here that there were those present who contended for a yet higher figure. The best mill results were attained during the campaign of 1888-1889, reaching about 207 pounds of dry product per ton of canes, 12½ per cent. of which is 25·87 pounds.

This "best mill result" has only been attained by one factory, and by this but once. Second mill honours, at between 175 and 185 pounds commercial sugar, have, however, been secured by respectively three other houses. Over these three diffusion shows, on the above base, a gain of above 47·87 pounds sugar.

Besides these four, we have heard perhaps of ten mill establishments in the State which, one time or another, have marked 160 to 165 pounds per ton, over which diffusion must accordingly have the call by not less than 68 pounds, or $3·74 per ton, more or less.

Lastly, behind the foregoing fourteen lie, steam or horse, about 750 mills, which, were they all accompanied by steam kettles of some sort, filter presses and vacuum pans, might be expected to average at the outside 130 pounds all around, or about 103 pounds less than diffusion could secure, other things equal.

In other words, if diffusion has by 12½ per cent. the advantage of "the best milling," it shows more than 25½ per cent. over the next best, more than 41 per cent. over the third class, and some 79 per cent. over the probable maximum average of all the balance.

It seemed further agreed that the extra cost per ton of cane worked, necessarily entailed by diffusion, amounted to about 30 cents. This difference was based upon a comparison of poor mill work performed at Des Lignes in 1888, yielding 136 pounds of dry product, and the diffusion work which it is now reasonable to expect there in 1890.

Since better milling involves the expenditure of extra power, as also extra evaporation, extra cooperage, extra freight and charges, extra labour and additional machinery, with additional interest, depreciation, insurance and taxes upon the last, besides high priced superintendence and chemist, the cost of production by such milling is likewise very materially enhanced per ton of raw material over that of ordinary work. The difference in productive cost, therefore,

between "the best milling" and diffusion is not so great as above by perhaps one-third or one-half. The best milling, for instance, is accompanied by maceration. This is said to have jumped the coal bill up 150 pounds per 1,000 of sugar this last year at Calumet, mainly through injury to the bagasse as a combustible.

It would seem as if this might end the Mill *vs*. Diffusion controversy, so far as relates to Louisiana, after its seventeen years of pros and cons. The "best milling" has been performed with an apparatus as costly at first price and far more costly in lost time and maintenance than a diffusion plant of equal capacity; and it might, therefore, be at least expected of any one possessing an unsatisfactory mill who desired new plant, that he would choose that which in any case promised by 12½ per cent. the greatest gross income. Mills which have been inadequate for cane have been found to suffice for the chips; besides which second-hand mills suited to this work are cheap, whereas new affairs, equal to the "best mill results" on cane, are at once extremely dear and extremely liable to ruinous accidents.

It is, of course, very unlikely that mills which can secure results equal to "the best" will be discarded for diffusion for some years to come. It is very likely, too, that in occasional instances it will prove better economy to spend some additional money on good existing mills, as a temporary expedient, than to assume at the moment the far greater expense of outright new plant. But it can not be considered good judgment to buy, at anything like the same price, the least effective, the least reliable, and the least durable and remunerative of two articles, when the only choice is between one or the other of these and ruin.

It may be consoling to those for the time unable or unwilling to purchase batteries and belongings that diffusion is as yet not perfected; that it is ultra complicated. These should consider, however, that, whereas it is a century old, the steam mill also is still imperfected. At this very time, indeed, there have just been brought to attention two new and most excellent devices, which, it is urged, should be adopted by all mills, namely, the forced feed and the compound—lever pressure—control apparatus, or the older hydraulic device already in use. To this hour no man really knows whether a mill's rolls may best be of large or of small diameter, whether fast or slow speeded, whether five or six in number or more, whether treated with hot water or cold, or assisted by shredder or cutter.

But what every one conversant with diffusion's true inwardness pretends to know is that, with the eight rolls, the seventeen spur wheels and pinions, the return plates, the rougheners, the hydraulics, the forced feeds, the maceration, the strainers, the scrapers, and the accidents and delays of the "best mill," and its attendant juices of lower purity, and its scum presses, it is both more complicated and less reliable, as well as less effective, than the newer process.

Paper Read by Mr. Adolph Seeliger before the Meeting of the Sugar Planters' Association, Feb. 13, 1890.

I take the liberty of bringing under your notice the following table to show how much sugar is lost by a good five-roller mill and how much by a good diffusion outfit:—

Mill.	Diffusion.
One ton of cane with 12 per cent. sucrose equals 240 pounds of sugar.	One ton of cane with 12 per cent. sucrose equals 240 pounds of sugar.
Seventy-five per cent. juice and 25 per cent. bagasse with 4·5 per cent sucrose, loss in the 25 per cent. bagasse equals 22·5 pounds of sugar in bagasse, and there is consequently obtained 2·40-22·5, equal to 217·5 pounds of sugar.	Ninety per cent. bagasse with 0·4 per cent. sucrose, loss in bagasse 7·2 pounds of sugar. Ten per cent. pressure water with 0·06 per cent. sucrose, loss in water 0·12 pounds of sugar, together with loss of 7·2, equal to 7·32 pounds of sugar, and there is consequently obtained 232·68 pounds of sugar.

Difference in favour of diffusion 15·18 pounds of sugar.

As you see, I take one ton of cane with 12 per cent. sucrose and have, consequently, in this ton of cane 240 pounds of sugar. A good five-roller mill gives 75 per cent. extraction and 25 per cent. bagasse, with 4·5 per cent. sucrose loss in the 25 per cent. bagasse, or 22·5 pounds of sugar, and we have, consequently, in the juice 217·5 pounds of sugar.

Now take one ton of cane with 12 per cent. sucrose to the diffusion outfit, and with the same 240 pounds of sugar as the sugar content.

We have by diffusion 90 per cent. bagasse with 0·4 per cent. sucrose, loss in this 90 per cent. bagasse 7·2 pounds of sugar; secondly we have about 10 per cent. pressure water with $\frac{6}{100}$ per cent. sucrose loss in this 10 per cent. water, or $\frac{12}{100}$ pounds of sugar; this is together 7·32 pounds of sugar lost, and we will then have in the juice 232·68 pounds of sugar.

You see we can make from the same ton of cane with diffusion 15·18 pounds more sugar than with the mill, but only if we work well with diffusion.

If we work badly, then we will lose much more sugar by diffusion than with the mill, and it is much easier to work well with the mill than with diffusion, because you can not work well with diffusion without a technical chemist who understands all the works of the sugar house practically, and can conduct a sugar house.

Many planters do not like chemists and chemistry, and to all these gentlemen I say, never build diffusion, but stay by the mill, because diffusion will make you more confusion than money.

CHEMICAL KNOWLEDGE APPLIED TO SUGAR PRODUCING IN QUEENSLAND.

Mr. Edward W. Knox, manager of the Colonial Sugar Refinery Company, Sydney, has read a paper before the Australasian Association for the Advancement of Science, on the application of chemical control to a manufacturing business. The great probability that the succcessful extraction of a larger quantity of sugar from the cane (thus enabling the colonial industry to compete successfully with the beet), can only be secured under the supervision and instruction of competent chemists, gives this paper a considerable value. We, therefore, commend it to our readers in all cane-growing countries, and make no apology for reproducing it as follows, nearly in extenso, from *The Queenslander*, of January 18th :—

As there are still doubts in many minds about the money value of scientific aid in practical work, I have thought that some interest might be taken in a short account of a purely commercial application of chemical science to a manufacturing business—an application, I think, unique in its completeness as far as Australasia is concerned, though in Europe, many better examples might easily be found, but few, if any, where the staff of experts is so large or the work done so wide in its scope. The business I speak of is that of the company known as the Sugar Company, which is largely interested in the manufacture and refining of sugar in five of the colonies of the Australasian group.

Having entered the service of this company twenty-five years ago, and having since passed through all its grades, I can speak with some authority of its transactions; but as I have not enjoyed any training in science, I will deal with the subject on which I am to address you, merely from the point of the view of one concerned with the results alone. About ten years ago we were led, by the great attention then being paid to chemical research in connection with the beet sugar industry, to commence such investigations into our mode of work. We did not know clearly what we wanted, nor did the man we engaged, so the first start was not a success; but it showed us that we were on the right track, and we accordingly engaged in Scotland a refinery chemist, and a year later, two beet sugar chemists in Germany, and began the systematic check on our workings. Of these gentlemen, the former is now our head chemist (Mr. T. U. Walton, B.Sc., F.I.C., F.C.S.), and one of the latter our inspecting chemist (Mr. Gustav Kottmann, Ph.D.), and it is to the patience and industry of the these two gentlemen, and to the system they introduced, that much of the success we have achieved is due. The chemical staff then fast increased in numbers, but it was not till I visited Europe, in 1885, and saw there to what an extent the supervision of industrial work was passing into the hands of those having chemical knowledge, that any large portion of the practical work was intrusted to members of our chemical staff.

I sought, however, authority for such a change, and during the past two or three years have gradually, as chances offered, transferred to men who were trained chemists or analysts the management of a large part of our manufacturing operations. The method adopted now is as follows. There is a central laboratory in Sydney, where the head chemist is stationed. Here five or six officers, including juniors receiving elementary training, are always at work, and to this centre all the returns from each factory are forwarded weekly.

At each sugar mill and refinery (nine and three respectively), there are employed a chemist or analyst and one or more juniors or assistants—not counting the officers who may be engaged in overlooking the manufacture,—and each of these analysts is responsible for the chemical investigations to be carried out at his station. At the mills these comprise:—

1. Analysis of the sugar cane as received.
2. Analysis of the juice expressed.

3. Analysis of the megass or crushed cane after the juice has been removed.
4. Analysis of the clarified juice.
5. Analysis of the clarified juice after it has been boiled down.
6. Analysis of the massecuite from the pans.
7. Analysis of the sugar and molasses.
8. Analysis of the coal.

And in addition a record is kept of the work done, and each week a statement is prepared which shows the quantity of cane crushed and sugar produced. The work, of course, is so arranged that the more important analyses which determine the amount of sugar lost in the various processes are made frequently, and those of smaller moment as time permits. At the refineries the sugar is all sampled and analysed according to the various brands on being landed from the ships, and it is stowed so that it can be procured as wanted. Each day's melting is again analysed, and the weekly averages of all sugars and syrup produced. There is also a careful examination made of the bone black used for filtering, to determine if this has been rightly re-burned, and full analyses of this also are made from time to time. The records of the work are prepared on different lines from those for the mills, but there is a similar check, and occasional investigations have also to be made into other points connected with the refinery work. At the end of each quarter for the refinery, and of each crushing season for the mills, the weekly returns which have been prepared are summarised and tabulated, and careful comparison made between the results at the various factories, improvements effected, or new methods suggested brought under the notice of the leading officers, and the occasional shortcomings are also relentlessly exposed by the figures recorded. The refinery returns are all under the charge of the head chemist, the mill returns under that of the inspecting chemist, and the whole of them are made out in such a way that the administrative heads of the different departments—who as a rule know nothing of chemistry—can grasp the main features very easily, and then at once deal with any matters which call for attention or explanation. All the work in connection with sugar is carried out by the aid of the polariscope, and, indeed, could hardly be done without this instrument, which has been devised to make a practical application of the property that a solution of sugar has of altering the character of polarised light allowed to shine through it. The degree of change thus experienced by the rays of light is in exact proportion

to the quantity of sugar present in the solution, and when measured by suitable prisms the amount of sugar thus becomes known. This apparatus is the outcome of a long series of experiments and discoveries commenced nearly seventy years ago, and it serves well to illustrate the dependence of practical work on purely scientific inquiry conducted for the acquisition of knowledge, and in this instance, I think, without thought of personal gain. So far I have spoken altogether of the manufacturing work, but I should here state that we have now also taken the chemical staff into our counsel in regard to the cultivation of the cane grown on our own plantations, at present about 14,000 to 15,000 acres, In past years we have not availed ourselves to any extent of the assistance of the chemists in this department, partly because we were working virgin land, and partly because till a short time ago nearly the whole of our supply of cane—and still a large proportion—was grown by others and sold to us when cut. However, the partial exhaustion of our lands, and the necessity for applying manure, the desirableness of improving the present canes and of introducing new varieties, and some little trouble with disease in the canes, compelled us to seek the aid of our chemical staff in this branch also, and we are now carrying out an elaborate investigation into the composition of the soils of our various estates; and, under the supervision of the chemists, a vast number of trials in the special cane nurseries established by us two or three years ago, and in the fields with manure of various compositions applied in different ways, and with irrigation and many systems of planting.

(To be continued.)

NOTES ON BOOKS.

Treatise on the Evaporation of Saccharine, Chemical, and other Liquids, by the Multiple System in Vacuum and Open Air, also the Construction and Working of the Different Systems. Compiled by James Foster, M.I.M.E. Sunderland: Thomas Reed and Co. London: Simpkin, Marshall and Co.; Hamilton, Adams and Co.; E. and F. N. Spon, &c., &c.

A laborious compilation by a practical mechanical engineer and inventor, giving minute details of most of the various systems of evaporation by triple and multiple effects, vacuum pans, &c., and their very numerous modifications. The information is in many cases

a literal translation of the descriptions of the inventors themselves or of reviews in foreign scientific and technical journals, or of treatises by experts, which, valuable as they are to those conversant with French and German, have not hitherto been available for the ordinary Englishman. So far as we are aware there exists no similar compendium in the English language, and as the advocates of diffusion are not only very energetic in calling attention to their various systems and processes, but seem to be making some headway in the colonies, this book cannot fail to become a desideratum in the library of every merchant, manufacturer, or planter interested in the question. We seem, however, to miss some names, which are rather familiar to us in connection with patents and modifications of diffusion processes, especially those of North Germany.

The work is too purely technical for elaborate review in a journal such as ours, but when, in addition to what has already been premised, we state that it consists of 750 pages of descriptive matter and illustrations, some 50 plates of machinery, over 50 elaborate tables for computations of every kind, besides numerous diagrams, enough has been said to show that no practical man in any way connected with sugar machinery can afford to overlook it.

The British Guiana Directory for 1890. Georgetown (Demerara), E. K. Jardine, *Daily Chronicle* Office.

We have received this little 12mo. volume of nearly 500 pages, which appears to contain almost every detail of information necessary for the enlightenment of either the resident, the visitor, or the stranger afar off. What specially interested us was the list of Sugar Estates and Sugar Estate Proprietors. Of the 102 plantations enumerated, 7 use the Common Process; 45 the Vacuum Pan System; 1 the two combined; 23 the Triple Effect and Vacuum Pan; 6 the Yaran and Vacuum Pan; 3, viz., La Bonne Intention, Lusignan, and Mon Repos—the Quadruple, Yaryan, and Vacuum Pan; while the following combinations of systems are in use on one estate each as specified:—Quadruple Rillieux, V. P., and Diffusion (Nonpareil, Mr. Quintin Hogg); Quadruple Effect and V. P. (Golden Fleece); Quadruple (Chapman) and V. P. (Providence); Triple Effect, Yaryan, and V. P. (Annandale); Triple Poleople and V. P. (Uitvlugt); Copper Wall and V. P. (Highbury); Yaryan (Vriesland).

This special test will serve to show the value of the book to those seeking practical information respecting this colony.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. THOMPSON, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

2416. C. W. GUY, London. *Improvements in and relating to crushing and leaching mills, especially applicable to the treatment of sugar canes.* 14th February, 1890.

2870. W. P. THOMPSON, Liverpool. (Communicated by Robert Maurin, United States.) *Improvements in or appertaining to apparatus for cutting sugar canes and other like plant stems.* (Complete specification.) 22nd February, 1890.

3240. A. A. BREHIER and B. G. TALBOT, London. *Manufacture of artificial tartaric acids by means of cellulose, saccharine, or amylaceous substances.* 28th February, 1890.

3589. C. STEFFEN, Vienna. *Improved process for obtaining the entire crystallisable sugar contained in more or less pure saccharine solutions, juices of plants, and the like, by employing the same for washing crystalline sugar mass in special manner before the said saccharine solutions are subjected to a novel method of boiling the same.* (Complete specification.) 6th March, 1890.

3606. E. CAREZ and LA SOCIETE GENERALE DE MALTOSE, London. *An improved method of saccharification of amylaceous materials.* 6th March, 1890.

3526. A. J. SALAMON, of 1, Fenchurch Avenue, London, Analytical Chemist. *Improvements in preparations of cane and beet sugar.* February 27th, 1889. This invention relates to the combination of saccharine with ordinary cane or beet sugar, and the specification includes details for mixing the former with the latter during certain stages of refining, or afterwards to the various grades of sugar.

8596. J. G. CHAPMAN, of 25, Austin Friars, London. *Improvements in and connected with apparatus for evaporating and concentrating saccharine or other solutions.* May 23rd, 1889. The bottoms of the evaporating pans are movable, preferably springing on pivots so as to be capable of dropping down like a sluice valve. By this means the contents may rapidly be drawn off, which is a great advantage in the case of thick liquors such as masse cuite.

20515. C. Stephen, of 40, Hengasse, Vienna, Austria. *Improved process for obtaining the entire quantity of crystallisable sugar contained in sugar mass.* December 20th, 1889. Pure hot sugar mass from the vacuum pan is mixed with molasses or factory syrup, and the crystals won by cooling in suitable vessels.

AMERICAN.

ABRIDGMENTS.

412231. John L. Becker, of Hartwell, assignor to the Blymyer Iron Works Company, of Cincinnati, O., U.S.A. *Evaporating Pan.* October 8th, 1889. In this evaporating pan the steam heating pipe gradually decreases in diameter and in this way a proper amount of raviation is secured for every part of the pan. This construction also causes a flow of the scum towards one side of the pan where it rises over the edge, and falls into a gutter. An inclined cover placed over one portion of the pan helps to direct the boiling scum, &c., in the right direction.

414436. J. W. Norton, of Westfield, N.Y. (assignor of one half to J. C. Fuller, of Kinzua, Pen.) *Evaporating apparatus.* November 5th, 1889. The use of this apparatus in evaporating brine is described. A wide V shaped trough is provided, along the deepest part of which is arranged a steam heating coil; the heat from this serves to raise the temperature of the brine into action is aided by numerous streams of hot air which are forced to bubble up by means of pipes provided with discs or deflectors at their exits. Travelling scrapers or buckets remove the product up the inclined sides, and deposit it in perforated chambers to drain. The damp air and moisture are passed to the outer air.

414608. E. Urbain, of San Francisco, Cal. *Ground bone furnace.* November 5th, 1889. This furnace has a double top to prevent loss by radiation, or inconvenient heating. The vertical retorts are in addition to the usual attachments provided with an intermediate support in the form of a frame or grating, into which they fit, and upon which they rest by means of flanges. Each retort or post is provided with a cover, having a small perforation, which allows the evolved gases to escape, but prevents undue ingress of air.

414696. T. Gaunt, of Brooklyn, New York. November 12th, 1889. *Evaporator.* The liquor trickles over the surface of a number of parallel tubes placed one above the other. Waste heat such as that from a furnace is caused to pass through the tubes, and in case

the heat should be at first too severe, the bottom tubes through which it first passes are kept constantly submerged in the liquor which is kept at a constant level. A large evaporating power is thus obtained.

415541. G. W. Lee, of Muncie, Indiana. *Evaporating apparatus.* November 19th, 1889. Two closed cylinders are placed a distance apart, and their interiors are connected by means of a number of pipes let into their end, and, in practice, the arrangement is caused to revolve on anti-friction rollers. Steam is passed into one of the cylinders, and passes through the pipes which it heats, the exhaust being through the second cylinder. The fluid under treatment is slowly fed on to the revolving pipes, and is there quickly evaporated, the product dropping into a vessel placed beneath.

415635. C. Hall and W. H. Wright, of East Farnham, Quebec, Canada. *Sugar sap evaporator.* November 19th, 1889. Means for giving a circuitous travel to the heated juice. If "niter" should form in the trays, it may be removed by reversing the flow of the liquor, and suitable means are provided for this purpose.

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, March 13th, 1890.

Fair Refining.	96o/o Centfs.	Granulated.	Stand. A.	Stock in Four Ports.
Mar. 13, 1890.—5 3-16c.	5 11-16c.	6 7-16c.	6 1-16c.	Jan. 1, 1890— 11,169 tons.
Mar. 14, 1889.—5⅛c.	5⅞c.	7c.	6¾c.	Jan. 1, 1889— 32,254 tons.
Mar. 15, 1888.—4¾c.	5 7-16c.	6¾c.	6¼c.	Jan. 1, 1888— 47,798 tons.
Mar. 17, 1887.—4 9-16c.	5⅛c.	5 11-16-¾c	5 5-16-⅜c.	Jan. 1, 1887—102,279 tons.
Mar. 18, 1886.—4 15-16c.	5 9-16c.	6¼c.	5 13-16c.	Jan. 1, 1886— 57,328 tons.
Mar. 19, 1885.—4 11-16c.	5 5-16c.	6 1-16c.	5⅝c.	Jan. 1, 1885— 89,186 tons.
Mar. 13, 1884.—5 11-16c.	6 9-16c.	7⅜c.	7c.	Jan. 1, 1884— 60,900 tons.
Mar. 15, 1883.—7⅛c.	7 13-16c.	8 15-16c.	8⅜c.	Jan. 1, 1883— 50,297 tons.
Mar. 16, 1882.—7⅛c.	7 15-16c.	9 3-16c.	8¾c.	Jan. 1, 1882— 43,927 tons.
Mar. 17, 1881.—7 5-16c.	8 1-16c.	9¼c.	8⅝-⅞c.	Jan. 1, 1881— 66,999 tons.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

January 1st to February 28th.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Germany	1,144,098	964,659	783,517	549,607
Holland	24,260	86,332	15,579	45,254
Belgium	241,984	206,890	146,033	101,217
France	22,345	458,305	14,706	274,768
British West Indies & Guiana	401,281	270,310	345,948	212,378
British East Indies	52,201	46,000	27,721	20,185
China and Hong Kong	....	....	....	....
Mauritius	5,698	50	4,261	44
Spanish West India Islands	....	....	....	....
Brazil	116,654	78,326	76,866	45,978
Java	123,848	46,705	99,730	35,245
Philippine Islands	54,405	30,200	27,226	14,735
Peru	142,309	170,536	104,447	116,418
Other Countries	129,290	65,072	84,677	46,695
Total of Raw Sugars	2,459,373	2,423,385	1,730,711	1,462,524
Molasses	24,139	14,950	8,677	5,871
Total Sugar and Molasses	....	....	1,739,388	1,468,395
Refined Sugars.				
Germany	770,583	729,844	672,413	593,175
Holland	228,950	271,861	209,957	226,020
Belgium	42,388	29,924	40,004	26,664
France	238,825	571,304	211,150	457,539
United States	5,338	282	4,393	568
Other Countries	*215,164	*98	*176,063	*73
Total of Refined	1,501,248	1,603,313	1,313,980	1,304,039

EXPORTS.—Refined Sugars.

	Cwts.	Cwts.	£	£
Sweden and Norway	12,012	13,502	8,844	9,541
Denmark	17,314	16,132	12,689	9,314
Holland	13,990	15,268	9,949	10,820
Belgium	4,429	4,522	2,902	3,038
France	3,195	555	2,225	390
Portugal, Azores, & Madeira	10,621	18,096	7,434	11,540
Italy	15,056	18,391	11,368	11,916
Other Countries	25,380	35,136	19,874	26,031
Total of Exports	101,997	121,602	75,285	82,590

* Imported almost entirely from Russia.

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of February, 1890, compared with the corresponding month of the two preceding years, and the average monthly imports for the past year compared with those of 1886, 1887, and 1888, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				Feb.	Feb.	Feb.	Monthly Average.				Feb.	Feb.	Feb.	Monthly Average.				Feb.	Feb.	Feb.
	1886	1887	1888	1889	1888	1889	1890	1886	1887	1888	1889	1888	1889	1890	1886	1887	1888	1889	1888	1889	1890
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France	1462	1363	1686	2373	1867	1734	2954	2688	5099	4855	8595	1517	3224	5169	4150	6462	6541	10969	3384	4958	8123
Holland	3508	3780	3267	2294	1634	3497	2725	1428	2483	2675	3354	2845	2905	3536	4936	6263	5942	5648	4479	6402	6261
Germany & Austria	990	1347	1510	2573	1175	2546	2862	6634	10463	11729	13844	5889	11614	14897	7624	11810	13239	16417	7064	14160	17759
Belgium	344	592	622	827	803	730	381	113	308	227	225	271	186	312	457	900	849	1052	1077	916	693
United States	854	454	8	..	..	..	..	5078	2804	157	42	10	42	13	5932	3258	165	42	10	42	13
Russia	..	3	..	23	..	..	..	3412	452	1959	2015	..	5526	..	3412	455	1959	2038	..	5526	..
Other Countries	..	..	1	239	..	..	..	9	15	2	355	..	6	..	9	15	3	594	..	6	..
Total	7158	7539	7094	8329	5479	8507	8922	19362	21624	21604	28431	10535	23503	23927	26520	29163	28698	36760	16014	32010	32849

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

To March 15th, 1890 and 1889. In Thousands of Tons, to the nearest Thousand.

	STOCKS.		DELIVERIES.		IMPORTS.	
	1890.	1889.	1890.	1889.	1890.	1889.
London	38	33	61	63	51	64
Liverpool ..	62	86	61	65	37	55
Clyde......	43	29	42	47	45	56
Bristol	3	3	16	14	13	13
Total ..	146	151	180	189	146	188
	Decrease.. 5		Decrease.. 9		Decrease .. 42	

The above figures do not represent accurately, or to the full extent, the position or movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Circular.)

For the four principal Ports. In Thousands of Tons, to the nearest Thousand. For February, 1890 and 1889.

	STOCKS. March 1st.		DELIVERIES. In February.		IMPORTS. In February.	
	1890.	1889.	1890.	1889.	1890.	1889.
New York	4	34	52	32	54	32
Boston	3	2	7	11	10	10
Philadelphia....	..	..	30	17	30	17
Baltimore	..	..	..	..	..	..
Total......	7	36	89	60	94	59
	Decrease.. 29		Increase.. 29		Increase .. 35	
Total for the year			190	133	185	137

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 28TH FEBRUARY, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	German Empire.	Austria.	Remaining four principal *entrepôts.*	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
159	307	66	500	263	32	1326	846	919

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 28TH FEBRUARY, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	German Empire.	Austria.	Remaining four principal *entrepôts.*	TOTAL 1889-90.	TOTAL 1888-89.	TOTAL 1887-88.
1311	479	45	430	265	359	2889	2790	2660

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.	1886-87. Tons.
German Empire	1,260,000	990,604	959,166	1,012,968
France	775,000	466,767	392,824	485,739
Austria-Hungary	750,000	523,242	428,616	523,059
Russia	475,000	526,387	441,342	487,460
Belgium	200,000	145,804	140,742	135,755
Holland	60,000	46,040	39,280	36,098
Other Countries	80,000	87,000	79,980	69,127
Total	3,600,000	2,785,844	2,481,950	2,750,206

Mr. Licht has again found reason to raise his estimate by the net amount of 50,000 tons, the differences being—Germany, 10,000; France, 25,000; Austria-Hungary, 20,000 tons more, and Russia 5,000 tons less.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

Cane sugars have been in steady demand during the month, but no activity has been displayed, and buyers have not shown any desire to add to their stocks. Low brown qualities have shown some animation, and on the whole there is a slight advance on last month's prices. Refined sorts, especially English, are decidedly weaker, probably owing to the abstention of retail buyers.

Beet sugars remain very steady, in spite of the large excess crop, and it begins to be evident that a very large portion of the excess will be absorbed before the next crop, owing to the deficient supply of cane. It is by no means impossible, in spite of the heavy beet production, that speculators may succeed in running up prices. There have again been considerable purchases of French beet in the Clyde market, where the stocks at the middle of the month, show an increase of 14,000 tons over the quantity held at the corresponding period of last year. The general stocks of the United Kingdom (four ports) show, however, a decrease of 5,000 tons as compared with last year, the difference being most marked in Liverpool. The imports into Great Britain were 42,000 tons less than in the corresponding month of 1889.

Present quotations for the standard qualities, as under, are :—

Floating.			Last Month.
Porto Rico, fair to good Refining	12/9 to 13/9	against	12/6 to 13/6.
Cuba Centrifugals, 97°/₀ polarization	14/3	,,	14/3 to 14/6.
Cuba, fair to good Refining	13/- to 13/6	,,	12/9 to 13/3.
Java, No. 14 to 15 D.S...	14/9 to 15/-	,,	14/9 to 15/-.
British West India, fair brown	11/9	,,	11/6
Bahia, low to middling brown	10/- to 10/9	,,	10/- to 10/9.
,, Nos. 8 to 9	11/6 to 12/-	,,	11/3 to 11/9.
Pernams, regular to superior Americans..	11/- to 12/9	,,	10/9 to 12/6.

Landed.			Last Month.
Madras Cane Jaggery..	9/9 to 10/-	against	9/9.
Manila Cebu and Ilo Ilo	9/6 to 9/9	,,	9/3.

Paris Loaves, f.o.b...	16/6	against	16/6
Russian Crystals, No. 3, c.i.f.	Nominal.		
Titlers	18/3	,,	18/6
Tate's Cubes..	19/6	,,	20/-
Beetroot, German, 88%, f.o.b..	12/1½ to 12/3	,,	12/3 to 12/4½

THE SUGAR CANE.

No. 250. MAY 1, 1890. Vol. XXII.

☞ The writers alone are responsible for their statements.

Cheques and P.O. Orders to be made payable to The Proprietor, 6, Ward's Buildings, Deansgate, Manchester. All other communications to be addressed to The Editor, at the same address.

For Table of Contents, see page i.

We learn from the proceedings of the Agricultural and Horticultural Society of India, that they have received from Thakur Jai Narain Singh, 20 seers (50 lbs.) of "Alapore Joar," sorghum seed. The Thakur mentions that he was unable to attend to the matter in October, at which time the seed ripens, and has therefore not been successful in obtaining a large quantity. It will now be possible to ascertain the value of this sorghum commercially. Some of the seed will be sent to Kew and some to the Agricultural Department, Washington, U.S.A., for trial and distribution.

The following extract from the annual report of the above Society explains the circumstances connected with the despatch of the seed in question:—

"The sugar yielding sorghums have for some years been under careful examination in America, and large sums have been spent by the U. S. Government in exhaustive experiments made in special factories built for the purpose. Some attempts were made a few years ago to ascertain whether the best varieties of the sorghums found most promising in America, could be cultivated at a profit for sugar in India. The 'Early Amber' was the principal variety selected, but the results obtained were very poor indeed, and for some time no further trials have been made. Inquiries have been received from America as to the sugar yielding sorghums cultivated in India; an application was made to Thakur Jai Narain Singh of Didwary, near Meerut, from whom a sample of sugar made near the borders of Bicanir State from the 'Alapore Joar' had been received, and the Thakur was able to

establish that a sorghum is grown in 'Hariana' from which sugar is made by the primitive native process which has been found so useless in the case of 'Early Amber' sorghum. A sample of the sugar has been received from the Thakur, and since the close of the year a quantity of seed. A most interesting fact has thus been brought to light, viz., that in a part of the country unsuited to the growth of sugar cane, a substitute for that plant is, and has long been, under cultivation. So far as the information yet received goes, the cultivation of this sorghum is confined to this one spot of country."

On the 9th of last month an influential deputation waited upon Baron de Worms, at Liverpool, for the purpose more especially of eliciting some expressions as to the views of the Government in regard to the Sugar Convention and the re-introduction of the Bill dealing with the Bounties question which was withdrawn last Session. In view of the importance of this question, we have decided to give a verbatim report of the speeches of Mr. T. O. Easton, the introducer of the deputation, and of Baron de Worms, which will be found on pages 230 to 241.

Though every ardent partisan of the abolition of these Bounties must feel some disappointment on reading the statements of the Under Secretary for the Colonies, yet those who have followed in detail every step of the negotiations, and read the Parliamentary and newspaper utterances on the point, must allow that Baron de Worms has done his best, perhaps more than any other man could have done, but that circumstances are, for the moment, too strong for him and for the Government.

The next step, if reports from such men as Mr. Jos. Görz and others equally well informed are to be trusted, is likely to be taken by the German Government, which is credited with the intention of abolishing the duty on the beets, and along with it the bounty on export which is connected with that duty. That this is no unfounded report is evident from a manifesto issued by the Executive Committee of the German Sugar Manufacturers, a translation of which will be found on page 242. Our own opinion is that the retirement of Fürst Bismarck renders less likely the arbitrary passing of any measure which may be opposed to the wishes of a large class who are deeply interested in the maintenance of things as they are. The

Emperor evidently means to pay more regard to the feelings of the various classes of the community than was the case under the iron Chancellor's rule, and we venture to doubt whether the measure indicated for the present will be introduced. The abolition of the bounties will be energetically resisted by the greater portion of the German sugar manufacturers.

An opinion seems to be gaining ground that the result of the deliberations in the French Chamber of Deputies on that portion of the Budget dealing with the sugar duties will be that the excédants will not be altered this year, but that the allowance now made to French Colonial sugars, on being exported to the mother country, will be extended so as to include sugars exported from these colonies to any other country.

The *Propagateur* (of Martinique), speaks in rather laudatory terms of a new turbine with continuous action, invented in that island, for which we notice a patent has been taken out in France by the St. Louis Refinery, of Marseilles. The system is said to have the following advantages: Greater quantity delivered in proportion to the filtering surface; less waste of power for equal production, due to there being no stoppages; the dispensing with all manual labours; and greater evenness in the product. The *Propagateur* says: The masse-cuite is introduced at one extremity; three or four minutes later, there issues, at the other extremity, white sugar, cool and dry, as fine an article as can be desired.

The sugar factory of Pointe Simon, which works on the diffusion system, is reported to be extracting 9·12 per cent. of sugar, the consumption of coal being 7½ kilos. (16½ lbs.), per 100 kilos. (220 lbs.) of cane. The director hopes with a larger heating surface to reduce this to 5 kilos. (11 lbs.) per 100 kilos. of cane.

Dr. F. Jessen, who has been experimenting on saccharine, says that the pure form is 360 times sweeter than cane sugar, and 300 times sweeter than beet sugar. The editor of the *Zeitschrift für Zuckerindustrie*, Dr. Strohmer, says that it can only be considered as a remarkable and entirely individual observation on the part of Dr. Jessen, that pure cane sugar, obtained from the sugar cane, should have any different sweetness from pure cane sugar, obtained from

the beet. We, however, still cling to the belief, however difficult may be the proof, that it is a fact that cane sugar from the cane is really sweeter than that obtained from the beet, the purity being relatively the same, and we are glad to find that such belief is not confined to Englishmen and colonials.

From Brazil continued drought, affecting sugar prospects very unfavourably, is reported.

In Cuba great loss has also been caused by the drought, and the numerous and destructive fires consequent on it, and the production, it is generally expected, will fall below the very low figure of last year.

The German sugar factory of Görchen (which has a capital of M. 500,000) closed its 1888-89 campaign with a loss of over M. 43,000, which raises the debit balance to M. 110,858. A new refinery, with a capital of four million marks, is being founded at Hamburg, the intention being to produce only refined sugar for export. The Rositz refinery proposes to pay 7½% dividend.

The Luzan sugar factory (Bohemia), which was founded in 1870, and had a capital of M. 250,000 (£21,000), is to be liquidated. On the other hand a new factory is to be set up at Nagy Atat, in Hungary, by the Ungarische Zuckerfabriks-Actiengesellschaft, which already possesses two large establishments.

The new United States Tariff Bill, as arranged by the Sub-Committee of Ways and Means Committee, has been modified before being presented to the House. The original scheme (see page 269) was to charge on sugar under and including No. 16 Dutch standard 35 per cent. *ad valorem*, and above No. 16 40 per cent. *ad valorem*. This would average about 50 per cent. reduction all round, and there was no provision for the payment of any bounty. The mode of classification would admit two grades of Demerara and West India raw sugars to enter, which would be merchantable without refining. The new project is to admit No. 16 and under free; those above to pay a duty

of $\frac{4}{10}$ cents per lb.; sugars manufactured in the country to have for 15 years a premium of 2 cents per lb. The admission of the finer beet sugars, 88% polarisation, will be facilitated by the new scheme. The consumption of sugar in the United States was, in 1889, 3,658,424,030 lbs., equal to 57·16 lbs. for a population of 64,000,000. Of this quantity 714,551,680, or over 19½ per cent., was produced in the States, though 106,048,320 lbs. was made from imported molasses.

On page 268 will be found a letter from an esteemed correspondent, and an extract from the present United States Tariff. We are informed that West Indian sugar comes under the No. 13 standard, but as it polarises from 85° to 96°, it pays between £9 and £10 per ton.

We have received the report of results obtained in the experiments at Dodd's Reformatory, Barbados, in 1889. These are exceedingly interesting and valuable to cane planters, and comprise experiments with manures, with varieties of canes, with the seed of the canes and seedlings, &c. We regret that we have not at present space to quote at length from it, but will find occasion to refer to it next month. Meantime we may inform our readers that the use of Ohlendorff's Dissolved Peruvian Guano, and Ohlendorff's Early Cane Manure, has again, for the fourth time (as we learn), proved most successful. Our West Indian and other friends engaged in cane planting would do well to get this report, which may be obtained from T. E. King and Co., Bridgetown, the official printers for Barbados, and study it carefully. The improbability of any immediate relief in the direction of the abolition of bounties, renders it more than ever necessary to neglect no means of obtaining the best possible results and increased yield by the employ of the best manures, by the assistance of chemical experts, and the adoption of improved machinery.

THE SUGAR BOUNTIES QUESTION.

DEPUTATION TO THE RIGHT HON. BARON DE WORMS, M.P.,
Under Secretary for the Colonies and
President of the International Conference on Sugar Bounties.

A deputation of gentlemen representing the various interests of the sugar industry, waited on Wednesday, the 9th of April, upon the Right Hon. Baron Henry de Worms, M.P., Under Secretary of State for the Colonies and President of the International Conference on Sugar Bounties, at the North Western Hotel, Lime Street, Liverpool, for the purpose of ascertaining his views as to the prospect of a settlement of the sugar bounty question. Mr. T. O. Easton presided, and there were present: Mr. George Martineau, Secretary of the British Sugar Refiners' Association; Mr. Charles J. Crosfield, Chairman of the Lancashire Sugar Refiners' Association; Mr. J. Ernest Tinne, Chairman of the West India Association, Liverpool; Mr. G. R. Sandbach, Mr. J. D. Crosfield (representing the Wholesale Grocers); Mr. J. W. Macfie, Mr. W. H. Tate, Dr. Schack Sommer, Colonel Pilkington, Mr James Fairrie, Alderman Garnett, Mr. H. J. Hampshire, Mr. Rankin (James Leitch & Co.); Mr. J. Higson and Mr. J. Higson, jun.; Mr. A. J. Fairrie, Mr. Alfred Chapman, Mr. E. H. Harrison, Mr. George Jager, Mr. J. Heap, Mr. Turner, Mr. Philip Harris, Chairman of the Working Men's Anti-Bounty Association; Mr. James Peters, President of the Liverpool Trades' Council; Mr. Joseph Goodman, Secretary of the Liverpool Trades' Council; Mr. George Parkins, late Chairman of the Liverpool Trades' Council; Mr. L. Drohan, Chairman of the Liverpool Labour Electoral Association; Mr. William Matkin, General Secretary of the Carpenters' and Joiners' Union; Mr. W. Winterburn, of the Liverpool Tailors' Society; Mr. D. Shields, Mr. J. Caldwell, Mr. James Buckley, Mr. J. Robinson, Mr. William Murphy, Mr. Phillip O'Dwyer, Mr. Simms, of Dublin; Mr. Farrall, of Waterford.

MR. T. O. EASTON, in introducing the deputation, said: Baron Henry de Worms, Sir, in consequence I presume of my political relationship to yourself the honour has been conferred upon me of introducing this numerous and influential deputation. I need hardly

say that in introducing this deputation my remarks will be of a very brief and also of a rather retrospective character. It is not necessary for me to enter upon the familiar story, as to how many Governments, for so many years, have been trying to solve this very vexed question. I will only allude to the fact that it has been the proud privilege—I hope I may say—of Her Majesty's present Government to bring this long debated matter to a successful solution, and that we are very near arriving, I hope, at a happy conclusion; in fact, it only requires the final action of the Government, as it were, to crown the edifice. We are still waiting for that action, and I think I may say, not only on my own behalf, but I believe on behalf also of every gentleman present, that we await that action with the utmost confidence, and that we feel assured that Her Majesty's Government will, in its good time,—and we quite allow that it is the most fitting judge of what that time should be,—take the necessary steps to bring the matter to a conclusion. The action that remains to be taken may be divided into two parts. There is the ratification which of course is to take place on the 1st of August of the present year, I think I am right as to the day, and the other step, which is equally necessary, is that an Act of Parliament should pass through the House of Commons in order to give effect to the provisions of the Convention. We know that the Convention has been almost unanimously agreed to, and we have no reason to believe that there has been any recent retrogression on the part of any country from the the position which it occupied at the final signing of the protocol of the Convention. But our main object in seeking you at this time is to hear your declaration on the part of the Government. It is to you, Sir, and to Lord Salisbury that we are mainly indebted for the happy condition in which this question has been placed. The conference called together by Lord Salisbury was the greatest which has ever taken place, including as it did the representatives of more countries than had ever met before in this country. Our Government were the conveners of that assembly, it was by their invitation that the representatives attended. It is due to your great talent, to your great industry, to your indefatigable zeal, and to the happy and diplomatic manner in which you were able to overcome the many difficulties which arose in your path, that we at last came to the conclusion which is certified in the minutes of the Convention. We are quite sure there is no retrogression on your part, and if people

with their lynx-eyed minuteness have been able to fancy they detected some weakness in the knee joints of some members of the Government, I think you will be able to assure us that such is not the case. I will now finally inform you that this meeting represents not merely the sugar industry itself but it has a far wider aspect than that. I may say that it largely represents the industrial interests of this great city and also of our colonies. We have the pleasure of having here our friend Mr. Martineau, of London, whose zeal and great work you know, and they, therefore, need no comment from me; then there is Mr. Charles Crosfield, who is Chairman of the Lancashire Sugar Refiners' Association; Mr. J. Ernest Tinne, who is Chairman of the West India Association of Liverpool; we have representatives of the brokers and sugar merchants of Liverpool, and of the wholesale grocers; last but not least, we have a representative in Mr. Philip Harris, of the Workmen's Refiners' Association; we likewise have the presence of two of the important members of the Trades' Council of Liverpool, who will very briefly, with your permission, address you on the details of the subject.

Mr. CHAS. J. CROSFIELD, in the course of his remarks, pointed out the great increase in the importation of foreign refined sugar, the great advantage to the agricultural and labour interests which would accrue from the growth of sugar beet in England and Ireland, and the conclusive arguments used by such sound free-traders as Mr. Gladstone, Mr. Goschen, and the *Spectator*, in favour of the abolition of bounties.

Mr. J. ERNEST TINNE, President of the West India Association, spoke next, alluding to a growing feeling in the Colonies that their interests were being neglected, and expressing the earnest hope that the mother country would not stand by regardless, while foreign countries were engaged in what he hoped would be an unsuccessful attempt to throttle the existence of the West India Colonies.

Mr. PHILIP HARRIS, Chairman of the Working Men's Anti-Bounty Association, and Mr. LAWRENCE DROHAN, Chairman of the Liverpool Labour Electoral Association, next addressed Baron de Worms, continuing the subject from their own point of view very ably and forcibly.

The RIGHT HON. THE UNDER SECRETARY FOR THE COLONIES replied as follows:—Mr. Easton and gentlemen, I think I need scarcely assure you that I have listened with the gravest attention to

the matters which you have brought before me, and that with all the points which you have so ably expressed, I and the Government whom I have the honour to represent deeply sympathise. Now, of course, in dealing with a political question like the one before us, we have to consider whether everything that could be done has been done, and, if not, what remains to be done to carry out the object which we all wish for. Mr. Easton, in introducing this deputation, said that it only required the final action of the Government to crown this edifice. In one respect of course my friend was right, inasmuch as the necessary crowning of the edifice consists in passing into law a Bill that shall give effect to the penal clause of the Convention. But you and those who are with you to-day know perfectly well that a Government may wish to carry a measure, and yet may find that wish very strongly opposed by others who do not share their views. I think this deputation will recognise the fact that Her Majesty's Government have been and are perfectly sincere in their desire to give legislative effect to the Convention which has been signed. Therefore I ask you to bear with me for a few moments while I endeavour to explain to you how it is that up to the present time that legislative sanction has not been obtained. The gentleman who just preceded me, and Mr. Harris who preceded him, made remarks which bore to my mind directly upon the question, namely, they said, if I understood them correctly, that they failed to understand why statesmen who when in office distinctly condemned the bounty, yet when in opposition failed to give support to those who wish to suppress it. I hope I may be clearly understood, in addressing this deputation to-day, that I do so without a tinge of party bias. My observations I ask you to consider as simply relating to the sugar question and nothing else. I do not consider myself either Conservative or Liberal, but I am simply addressing you as the President of the Sugar Bounties Conference, and speaking, I think, in your interest. Let me ask you to consider how the efforts of the Government were met? Mr. Easton, Mr. Crosfield, and other gentlemen recognise the fact that the Conference, through the action of Lord Salisbury, although with very great difficulty, succeeded in bringing together so exceptional a number of international representatives, and that, what was much more extraordinary, there was, practically, unanimity among them. Everything, therefore, assumed the most favourable complexion for a successful result. I introduced a Bill into the House of

Commons, and I think that those who did me the honour either of listening to or reading my speech will acquit me of having expressed any extreme protectionist views. I claim to be as much a free trader as any gentleman I have the honour of addressing. It was on the strict principles of free trade, as understood by myself and understood by the Government, that that Bill was introduced. And surely if any evidence were required for the truth of that assertion it is to be found in the fact that Mr. Goschen, who is certainly recognised by every party as a free trader, was one of those whose name was on the back of the Bill, and who at Hull made use of those words quoted by my friend Mr. Crosfield,—that the object of the Bill was to set free the ordinary and natural sources of supply. I do not think anybody could possibly turn or twist that phrase into a leaning towards protection. Instead of being met, as I had reason to hope I should be met, with the support of all parties in the House of Commons, I found myself assailed from the commencement with the most violent opposition. Here I think I ought to pay a very just tribute to the one member of the opposition who stood by me bravely during the debate—I mean Mr. Burt—who I consider is a real, I will not say the only regular, representative of the working classes in the House of Commons. But when I mention that gentleman's name I have come to the end of the list. I received no support whatever from any member of the opposition, and the very members of the opposition who, when in office, declared that bounties were prejudicial to trade and contrary to the principles of free trade, were the very first to assert, both in the House of Commons and out of it, that the measure which the Government was introducing was a protectionist measure. I must say, and I think perhaps you will agree with me, that that is carrying party warfare rather too far. There are questions, as my friend Mr. Harris said, which ought to be above party warfare. Social questions, industrial questions, questions which affect the well-being of the masses generally irrespective of politics, ought to be treated irrespective of politics. I do not think any one of my political opponents would say that I introduced into this discussion a shadow of partisanship or a tinge of any political conviction I myself might entertain. Not only did these opponents of the Bill take up this extraordinary line, but they did worse, they suggested to foreign Powers by their speeches, a means of combating the measure which we were introducing. If you will

turn to the speeches of many leading statesmen, you will find that their main argument was, that if this Bill came into force, and the convention were ratified and subsequently executed, foreign Powers who might not agree with it would take the opportunity of denouncing the "most favoured nation" clause in their Treaties of Commerce with us, and would do more, they would when occasion arose, denounce those treaties of commerce themselves. We are all familiar with the old English saying, "don't nail his ears to the pump." There is a means of suggesting to a man a thing that you think he ought to do, while you know that if he did it it would be contrary to the ordinary rules even of society or of civilization, and that was the suggestion which was used by the opponents of this measure and with this result. No sooner had those utterances been published in the press of England than they were copied into the press abroad, and were re-imported into this country as evidence of the feeling of the foreign Powers against Clause 7, which is the essential portion of the Convention. Then, besides that, there arose a very unfortunate circumstance in connection with this Convention. At the very moment that the Bill was introduced into the House a sudden rise took place in the price of sugar. I remember saying, in introducing the Bill, that I believed the effect of the bounties would be that sooner or later we should see sugar at famine prices. And the argument I used was this: That while the source of supply remained unopened in our Colonies, it was perfectly clear that foreign Powers had virtually the monopoly, and that by exercising that monopoly they could at any moment corner the market and produce an artificial inflation of the price. My words were altogether misconstrued, and I am alleged to have said there would be a famine in sugar. I said nothing of the sort; but I did say that by a certain process the price might probably become a famine price. Unfortunately, my prediction was realised. What use did our opponents make of this famine price? Why they stumped the whole country, and declared that the Convention, which had not come into existence, and the Bill, which had not passed through the House of Commons, had had the effect, by reason of anticipation, of raising the price of sugar all over the country, and that, therefore, the action of the Government was to damage the consumer for the benefit of the sugar refiner. A more monstrous, a more ridiculous, a more unjust argument has never been used at any time in the

politics of this country. If this argument had simply been used by men who were absolutely irresponsible and whose words had little import, why the very utterances themselves need not have been noticed. But who are the men who made those utterances? Foremost among them was Sir William Harcourt. Only last week in a speech Sir William Harcourt repeated the very words I have mentioned to you, he asserted that the Bill of the Government had had the effect of raising the price of sugar to the working class. I could mention many others who used the same argument. It was repeated by Mr. W. E. Gladstone, by Mr. John Morley, by Sir Lyon Playfair, by Lord Granville, by Mr. Broadhurst, and by Mr. T. P. O'Connor, representing the Scotland Division of Liverpool. I think if we are engaged in a controversy from which all party considerations should be banished, it is quite clear that we must deal with the facts as we find them quite irrespective of the men who make use of them. If on the same side of the House as myself men should make use of the same argument I should be the very first to give their names to the public. I merely use these facts to show you that the action of the Government has been impeded in a manner which was far beyond their own control, and if we are now to combat this opposition the hands of the Government must be strengthened by you, gentlemen, and those whom you represent, so that we may be able to go before the country and say: "This is not an agitation on behalf of a few operatives, representing only four or five thousand—although these numbers have been immensely minimised—this is an agitation, this is a measure which has for its object the promotion of free trade principles, the abolition of a system which is iniquitous and which ought to be abolished, and which has the result not only of paralysing the trade of our Colonies and impeding its progress, but of destroying the industry of our country and throwing into the hands of the foreigner the trade which legitimately belongs to Great Britain." I hope and believe that your action will so strengthen the hands of the Government. Now, I may remind you what Lord Salisbury said in answer to Lord Granville when, at the commencement of the session, he asked him what the views of the Government were in regard to this Bill. His lordship explained that the real difficulty in passing this Bill through the House arose from the position that France had taken up; from the non-intervention of so large a sugar-producing country as Brazil; from the increasing spirit

of protection in the United States; and from the illegitimate use of party warfare which had been made use of to counteract the action of the Government. With regard to the action of France, I think it as well to remind you—alluding to an observation made by one of my friends that all the Powers were of the same mind—that France had not changed her mind up to the very day when the treaty was signed; that I, who ought to have been well informed on the subject, was under the impression that it was the intention of France to sign that Convention. It was only on the very day of signature that France raised objections and only signed, as you know, under protest, or rather deferred her signature, reserving to herself the power under one of the articles of the convention to sign it later. Since that time, although various moves have been made in the direction of diminishing the bounties in France, no move has been made for their abolition, and the English Government have not been approached by France in the direction of accepting the Convention which she failed to sign on the occasion when the other Powers did so. Then, again, in regard to Brazil, I need not remind you that Brazil is a Power which produces a vast amount of sugar, and Brazil is governed to a great extent in her action by the action of the United States, and up to the present time there has been no move on the part of Brazil which indicates her willingness to come in under the Convention. With regard to the United States, as I before mentioned, their tendency is increasingly protectionist, and we have no evidence either that they will join us in this Convention. But setting all that on one side, what you have to consider, what I venture to suggest to you, is this: that your interests must be advanced in a great measure by yourselves. A Government can always help an industry, or a movement, with much greater facility if the pressure comes from without. Let me point out to you another thing. I am speaking plainly here because I think it is better you should know exactly what I think upon this matter. When I first had charge of the sugar negotiations I received a notification of approval from the secretaries of the various trades unions throughout the whole of Great Britain, and the number of persons represented was about 500,000. The names of all those trades unions will be found in the Blue Book. They were all published and presented to Parliament. I am bound to say I had a right to expect more support from those trades unions than I received when the agitation was at the most critical point. When the Bill had been introduced a first time, and when the question was that it should be read a second time,

we had a right to expect that those men representing the great trades of the country should come to the Government, tender their assistance, and show that the agitation was a real and a growing one, and so prove the importance of the interests at stake. This would have so strengthened the hands of the Government that it would have been possible, and even easy, to go on with the Bill. This, however, was not the case. I do not think there is anybody here who can contradict it. For what reason I am quite unable to say, but the fact remains the same, that support was not forthcoming. The only representative of the trades union who really gave valuable assistance to me in the matter was Mr. Shipton. He did it without fee or reward, whatever may be said to the contrary. I know Mr. Shipton intimately, and a more honourable, more straightforward, more disinterested representative, although he represents a shade of politics absolutely different to mine, I never met with. He worked entirely in the interests of the working classes, and left himself entirely out of the question. At a moment when he was in great mental distress, and when his wife was dying, he came and assisted me in working out the details of the question and in explaining to me the views of the working-class upon it. I cannot say as much for another representative of the working class—Mr. Broadhurst—for the one opponent who certainly did great damage in the House of Commons and out of it was Mr. Broadhurst. I am not saying here what I have not told him already, and I challenge him to deny it. I only say this to show that our opponents were furnished with weapons against ourselves. On the one hand, they said the Government were carrying out a policy which they believed and knew to be opposed to the wishes of the working class. But we were supported by the Trades Unions of the country, and, therefore, we have a right to say we were speaking in the name of the working men. Still, when the agitation reached that stage when the working men ought to have supported it, we did not receive that support we ought to have had. I urge you, as a deputation in a city of the first importance in England, to do your utmost to disprove the statement used by our adversaries, that the working class of this country take no interest in the abolition of the sugar bounties. They use it in two ways. First, they say they take no interest in it because it is an industry confined to a small class, and then because they are convinced that it means an increase in the price of sugar. Both these arguments are fallacious. It is not in the power of the Government to disprove it, but the

power who can disprove it is the industrial class. The working classes themselves can disprove it, and not alone the employers of labour and those who are themselves workers in sugar refineries. If you will do that, you will so far strengthen the hands of the Government that they will be able to go on with better heart and have a better practical result than last session. The Government are determined, as they have always been, if possible, to ratify this treaty. It is not likely that the Government would have called together a Conference under such circumstances—such adverse circumstances; would have gone so far as to get an assurance from the great Powers that they would abolish sugar bounties, and then not carry it to any practical result. A Government, like an individual, is not always master of the situation. The working-class of this country must bring pressure to bear upon their parliamentary representatives. They must show, whether they be Conservative, Liberal, or Radical, it makes no difference at all, their representatives in Parliament that they wish them to take up this question because they consider it an important and burning question. Then, by so doing, assuming that that influence really bears fruit, the Government will be so far strengthened that they will not have to contend with the opposition which they had to contend with last session, and which rendered the passing of the Bill an impossibility. I am afraid I am taking up a great deal of your time. Still I think it is very important that we should consider this question under all aspects. My friend, Mr. Harris, alluded to the agricultural aspect of this question; Mr. Crosfield and in fact all the speakers alluded to it. That is an aspect of the most enormous importance, and I may say now what I have repeatedly said in the House. When I was in Holland I had the opportunity of speaking to one of the great experts who held the same opinion now expressed in the article in the *Farmer's Magazine*. He held that we could grow beetroot in England and notably in Ireland with the greatest possible advantage. Surely that adds considerably to the importance of the agitation, but it is perfectly evident that no man would be mad enough to embark in a new agricultural industry if he knew from the beginning that he would be handicapped by a foreign grower, receiving either a bounty on the production of the root or on the exportation of the sugar. But if those bounties are abolished, there is no earthly reason why the experiment should not be tried on a large scale. I myself believe it would be eminently successful, and I need not point out to you what a brilliant future

there would be not only for the workmen but for the whole of those concerned in the sugar industry of this country. Here you have another powerful element in the agitation in favour of the abolition of bounties. You have first of all the interest of the working class and the misery which is entailed by the closing of these sugar refineries. And here I would remark that those philanthropists who pose as friends of the working men seem to treat this question very lightly from that point of view, when they say there are only a few thousand men employed in the industry. They seem to care very little whether the few thousand men employed in it have employment provided for them or starve. After all that is what it means. The closing of the refineries and throwing out of employment thousands of hands means, virtually, starvation to the men. I think I am speaking correctly when I say that men who have worked all their lives in a sugar refinery are unfit for any other occupation. That is a most powerful argument. Add to that this new element which has been introduced, namely, the probability of being able to cultivate beet in this country and so improving the agricultural prospects of England, Ireland, and Scotland, and greatly benefitting the working classes by giving them more employment, then you have very powerful influences which may be brought to bear in support of the Government. If that be the case, as I am convinced that we could produce beet quite as cheaply as Belgium, Holland, and the northern part of France, then instead of employing as we do now only a few thousands of men, we should be able to employ a great many thousands, and thereby greatly add to the prosperity of the working class as well as develope a very large and important industry. I should not like to conclude my observations without alluding to the few remarks made by Mr. Tinne when speaking on the colonial question. At the present moment that has an especial interest for me as representing the Colonies in the House of Commons. I can assure Mr. Tinne, both from the colonial as well as from the general point of view, that Her Majesty's Government are extremely anxious that the sugar bounties should be abolished. My correspondence with the Colonies tends to show that there is a general feeling of opinion, in the large as well as small Colonies, in favour of their abolition. It only requires a strong pull on the part of those interested in this country to bring the movement to a head, and to strengthen the position which the Government has already taken up, not to confirm them in the opinion which they have, because that

opinion does not require confirmation. Her Majesty's Government holds the same view now that it did when the conference was first held. What is wanted is assistance. No matter whether the Government be Conservative or Liberal, it requires, in a great movement like this, assistance from without which would find sympathy and support within the House of Commons. If you will provide that; if you will show the Government of the day that you are really in earnest; if you will show them that you have at your back the working men of this country; if the trades unions will not only put their names to requisitions, but, when the hour of danger comes, be foremost in the fight, then, I think, we shall be able to show you that your wishes can and will be accomplished. On the other hand, of course, if you throw the whole responsibility on the Government and do nothing but show apathy, then, I am sure, you will have yourselves to thank if the result is not as satisfactory as you wish. I do not know whether there is any point you would like to put to me. I shall be glad to answer any question that may be asked. I have spoken quite openly and plainly upon the question.

Mr. George Jager: Supposing you have the assistance you are asking for, and working men are able to influence members of Parliament, would Her Majesty's Government carry through this Bill in spite of the opposition of France, if France persisted in refusing to sign the Convention?

Baron H. de Worms: My answer to that would be this: As I said before, the views of England have been transmitted to the Continent and have strengthened the opposition of the Continent and of France notably to the measure. My own impression is if the Government of that country could see that the opposition of the House of Commons had so far diminished as to be virtually no opposition at all, I think that is the most powerful lever that could be brought to bear upon the opposition of France, and probably France could by that means be overcome.

A vote of thanks to Baron de Worms for his very able statement was moved by Mr. W. H. Tate, who expressed a feeling of disappointment that the Under Secretary could hold out no better hopes of the passing of the Bill. Mr. Tate declared that if the crops of beet and cane sugar, and the conditions were next season to be such as they are at present, the sugar refining industry would be in a very disastrous position. Mr. Easton, and Mr. D. Shields supported the motion at some length, and it was carried by acclamation.

MANIFESTO OF THE GENERAL COMMITTEE OF THE GERMAN SUGAR MANUFACTURERS.

The Committee of the German Beetroot Sugar Manufacture Association, at their meeting on the 16th April, fully discussed the alteration of the law of 9th July, 1887, relating to Sugar Duties, which is being referred to in the public journals, and which is said to contemplate the total abolition of the tax on the raw material. Regret was universally expressed that after a radical alteration of the laws previously in force had been introduced only two years ago the industry should once more be disturbed. During these two years the prevailing circumstances had been by no means normal, and it is not even yet possible to estimate accurately the net income to the Treasury resulting from the operation of the law. In the meantime the expenses of the industry have been materially increased, as the cost of indispensable materials, especially coal, is considerably higher, and a rise in wages has to some extent taken place and is still further to be looked for. It is needless to state that owing to these causes the ability of the German sugar industry to compete in the markets of the world is sensibly interfered with. On the other hand the prices in open market afford no satisfactory compensation, and at present there is no hope of any improvement in this direction. Under these circumstances the industry cannot dispense with the support which is afforded by the bounty resulting from the tax on the raw material, when the manufacturing operations are carefully and intelligently conducted. Without this bounty it would be exposed unprotected to the attacks of foreign sugar industries, which, as is well known, are favoured by much higher premiums. Influenced by these considerations the Committee of the Association have unanimously agreed to make representations to the Imperial Government protesting decidedly against the abolition of the tax on the raw material. The Committee believes itself justified in assuming that the organs of the agricultural industry will join in this protest, as the decline of the sugar industry must necessarily have the most serious consequences for the agricultural interest.

THE CANE SUGAR INDUSTRY IN LOUISIANA.

(Continued from page 206.)

DES LIGNES.

The cane is reduced to chips by a Ross 48 inch level feed cutter, a cut of one inch being adopted, the chips being afterwards passed through Swenson comminutors. The battery is in double line and consists of 14 cells, each 15 feet deep, with 50 inches diameter and cubic content of 204 feet.

The syrup is granulated in 7½ foot vacuum pans of the usual style and the masse cuite is dried in four Hepworth hanging centrifugals. The styles of the sugar made were yellow clarified, granulated seconds, and wagon sugars. In the last run the sugar was not washed in the centrifugals.

The tonnage of cane for the crop was 6,868 tons, which yielded 1,368,005 pounds of sugar. The double mill produced last year from this amount of cane 927,180 pounds of sugar, or 135 pounds to the ton. The difference, 440,825 pounds, is quite a crop in itself. And this is notwithstanding the fact that the cane last year was lower in sucrose and higher in glucose than the year before. The following is the report by runs:—

	Tons of Cane Diffused.	Pounds Sugar Made.	Pounds Sugar per ton Cane.
First run	571	96,491	169
Second run	1,448	259,388	179·1
Third run	2,291	468,994	204·7
Fourth run	2,558	543,122	212·3
Total	6,868	1,368,005	199·2

The normal juice was as follows:—

	Sucrose.	Glucose.
First run	12·77	1·36
Second run	13·41	1·21
Third run	14·39	1·13
Fourth run	14·1	1·58

The following table will enable a comparison to be made between 1888 and 1889, although it is fair to say that the cane in the early part of the season is not as good as it is in the four last weeks:—

	Solids.	Sucrose.	Glucose.	Coefficient purity.	Glucose ratio.
Average of juice last four weeks of 1888	15·80	13·84	·95	87·60	8·15
Average of juice entire season of 1889	16·95	13·65	1·32	70·32	9·64

The coal consumed at Des Lignes per 1,000 lbs. of sugar for the 1888 crop (with milling) was 946 lbs., and for 1889 (with diffusion), 1,597 lbs. On the fourth run it was, however, only 1,090 lbs., and the proprietor believes that he will not hereafter require more than one lb. of coal to one lb. of sugar.

STELLA PLANTATION

Possesses the largest diffusion plant in the United States. The cane is cut, as at Des Lignes, by a 3 foot Ross level feed cutter, the size of chips adopted being 1½ inches, and the chips are also here passed through Swenson comminutors.

The battery is in double line and has 12 cells of 11 feet deep and 4 feet diameter, capacity 140 cubic feet. At both Des Lignes and Stella the chips are burned, at Magnolia they are not used as fuel.

No statement of results is given for Stella.

GLENWILD PLANTATION.

Here also is a 48 inch Ross cutter, and Swenson's comminutors are used for preparing the chips.

The battery consists of 16 cells, 12 feet deep and 48 inches diameter, the cubic content being 175 feet.

The chemist's report was not complete in time for publication. The quantity of cane worked up last season was 8,485 tons, from which 1,535,000 lbs. of first and second sugars were obtained. The third sugar is estimated at from 12 to 15 lbs. per ton, making a total of say 195 lbs. per ton of cane. With a double mill, in 1888, 10,460 tons of cane were crushed, producing 146 lbs. of all sugars to the ton of cane.

LAGONDA PLANTATION.

The same Ross cutter (in this case with level feed) and Swenson comminutor are in use here as at Glenwild.

The battery is of 12 cells in double line; the size of the cells is not given in the Report.

The yield obtained at Lagonda last season was 185 lbs. of sugar per ton of cane. The average yield obtained with the mill for the years 1884-87 inclusive was 145 lbs. The proprietor of this plantation read a paper at the meeting of the Sugar Planters' Association in February this year, the conclusions at which he arrived being as follows:—

1. That diffusion returns from 35 to 50 lbs. more sugar per ton of cane than the average of the twenty best mill sugar houses in the State.

2. That it will enable the planter to calculate in advance with reasonable certainty, and with much greater certainty than the milling process, what amount of cane can be worked up each day of the season.

3. That the increased cost over mill work for fuel and labour will not now exceed 15 per cent. of the value of the increased yield obtained, with a strong probability that this 15 per cent. can be reduced one-half with two more years' experience.

In our February issue of this year we have already given details of Lagonda and Glenwild estates.

MILL WORK AT CALUMET.

We have already (see *Sugar Cane* for December, 1889,) supplied to our readers a tolerably detailed report of the results of mill work at Calumet, which has been one of the most successful of those plantations which adhere to the milling process, a success which Mr. Wilkinson attributes mainly to the judgment, ability, and perseverance of the proprietor, Mr. D. Thompson, and his son, Mr. W. J. Thompson, as there are other mills equally well equipped. We would, therefore, refer to the report already presented (as above), contenting ourselves with the following additional details from the report of Mr. Wilkinson now before us:—

Campaign.	Commercial Sugar per Ton Cane. Lbs.	Remarks.
1879	93·05	3-roller mill, open kettles, vacuum pan, centrifugals, 3 sugars.
1880	100·79	3-roller mill, open kettles, vacuum pan, centrifugals, 3 sugars, part of crop boiled to 3rd.
1881	115·19	3-roller mill, open kettles, vacuum pan, centrifugals, 3 sugars, no thirds boiled.
1882	....	Overflowed. No cane ground.
1883	143·03	Machinery as before, with clarifiers added. No thirds.
1884	145·42	Machinery as before, with clarifiers and bagasse-burner added. No thirds.
1885	132·44	Falling-off in yield due to freeze. 5-roller mill. No thirds. Yield per ton stubble, 154·74.
1886	161·34	Double-effect added. No thirds.
1887	177·00	Filter-presses added. One-third of crop boiled for thirds.
1888	206·85	Whole crop boiled for thirds.

The maximum was reached in 1888, and although a third mill was added last year, and maceration practiced throughout the season, the yield fell off considerably. The deficit may be partially accounted for by there having been no third sugar boiled; but the principal cause was the low purity of the juice, a difficulty that was generally experienced in the sugar regions of Louisiana and Texas.

The fuel consumption for the last four crops, covering the entire period since the erection of the double-effect, was as follows:—

Campaign.	Coal per 1000lbs. of Sugar. Lbs.	Coal per ton of Cane. Lbs.	Remarks.
1886	653·00	105·4	No third sugar.
1887	665·50	117·8	One-third of crop to third sugars.
1888	630·48	130·41	Maceration on about half of crop. Third sugars.
1889	800·07	147·26	Maceration on whole crop. No third sugars.

As the extra evaporation due to maceration is almost entirely performed by exhaust steam, which otherwise went to waste, the increased amount of coal is attributed by Mr. Wibray Thompson largely to the poorer quality of bagasse which results from maceration.

(Concluded.)

THE ADAMSON PROCESS OF CANE-ROASTING.

By Judge O. B. Hamilton.

In the consideration of the present condition of the sorghum-sugar industry in Kansas, there are certainly substantial grounds for congratulation. From the report of Mr. Kellogg, State Sugar Inspector, we learn that with the seconds yet to be run the crop of 1889 will yield in round numbers 1,500,000 pounds, which is about three times as great as the yield of any previous season. When it is considered that this was the output of four plants, two of which were built and one rebuilt in 1889, and being late in getting ready for work, the results are very gratifying. Notwithstanding, by reason of delay in completion and very poor quality of cane, four diffusion plants and

one Adamson roaster plant were unable to produce any considerable quantity of sugar. Had these plants been completed in time, and had cane of the same quality as that worked by those other plants, the result would have probably been 5,000,000 pounds. These plants will all be ready for operation at the beginning of the season of 1890, and there will be a strenuous effort made to secure a better quality of cane for next season's work. For there is no doubt that in this question of securing a quality of cane having a greater quantity of sucrose content, largely lies the future success or failure of the sorghum-sugar industry. The most perfectly adapted and adjusted machinery, with the most skilful operatives, will not be able to produce sugar from cane that does not contain it. Hence the necessity for the greatest effort to make the best selection, and have the best cultivation that seed will produce, when ready for the mill, the greatest amount of sugar. This part of the work necessarily rests with the farmer. While it may seem that the development of this industry has been slow, if we but look at the matter fairly we shall see that it is only four or five years since sugar was first produced in Kansas, and then consider that it has taken twenty years to develop the manufacture of beet sugar in Europe, and much longer to develop the manufacture of cane sugar, we certainly have no room for discouragement.

All of the sugar plants in this State, save one, are operated by what is generally known as the "diffusion" process. It is readily and cheerfully conceded that with proper management, and with a good quality of cane, these plants will yield good profits to the stockholders. Yet it is of the other, or "Adamson roasting process," that we design to speak more especially. This process was the result of many years of labour and study in growing and working sorghum cane by Mr. A. J. Adamson, of Nemaha county, in this State. A very simple circumstance first directed his attention to the utility of roasting the cane. While stirring the fire under the evaporators with a cane stalk, he noticed that after the stalk had been some time in the fire, and become very hot, upon removing it the molasses would exude from the cane; and upon removing the shell the pith of the cane was much sweeter than before roasting. Pursuing these experiments for some time, he became satisfied that he had made a valuable discovery, and procured a patent therefor.

After securing his patent on the process, he proceeded to erect a roaster 20 inches wide and 35 feet long, which was successfully

operated for two seasons for making syrup, producing a very superior quality, much of which turned to sugar in a very short time.

In the spring of 1889, the matter of the manufacture of sugar from sorghum became a very important subject to the people generally in southwestern Kansas, and more especially to the farmers, for the reason that having lost two crops, it became absolutely necessary that they should have a market for a crop that they could raise with certainty, in order to be able to hold their claims and stay in the country. It was generally conceded that sorghum was a sure crop, and if sugar plants could be erected they would have a market for their cane, and their homes and the country be secure. Under these circumstances, the parties now interested in the American Sugar Company, having heard of the Adamson process, made a careful and thorough investigation of it. Satisfying themselves of its substantial merits as a process for making sugar economically, they arranged with Mr, Adamson to organise and put the process into practical operation.

Subsequently the plant at Minneola, Clark County, was erected, at a cost of about $35,000. The peculiar feature in this plant is the roasting department. This consists of a cast-iron tube 70 feet long, 4 feet wide, 4 inches deep, with flat bottom and arched top, the top being perforated with holes to let the gases and smoke arising from the burning blades and roasting cane escape from the tube. There is an endless-chain carrier passing through this tube and extending beyond it at each end, upon which the cane is laid (after having had the tops cut off), and is carried through the roaster to the mill where it is crushed. There is a furnace at the back end of the roaster, and a four-inch space all around it, so that when it is fired the heat passes on all sides of it, thus giving the heat access to every part thereof. The fuel used is the bagasse or crushed cane as it comes from the mill. The cane is about five minutes in passing through the roaster, during which time the leaves are burnt off, and the green vegetable matter in the shell of the cane is burnt or dried up, and the shell of the cane rendered soft, so that it is much more easily crushed, and the extraction more perfect than with the unroasted cane; the juice expressed being free from the vegetable impurities as above stated, and in better condition for concentration.

In passing through the roaster from 18 to 25 per cent. of the water is evaporated from the cane, and this concentrated juice reaches the defecators at a temperature of 158° F. It will be readily seen that

the steam necessary to raise the temperature of the juice to this point is saved, as is also that necessary to evaporate the water that is expelled from the cane in the roaster. This all means economy in fuel.

After reaching the defecator, the defecation and concentration can be effected by any of the means generally used, either by triple effects and vacuum strike-pan, or by the open evaporator.

At the Minneola plant the past season the "John F. Porter" evaporator has been used, but it is contemplated for the coming season to supplement it with a vacuum strike-pan. The roaster does its work perfectly, and from the report of the chemist, J. George Lumelius, an extract of which is here given, it will be seen that the extraction is very good, only leaving 3 per cent. of sugar in the bagasse. The extract from the report is as follows:—

"The advantages of the roasting process are as follows:—A softening of the cane, which renders pressure more effective; a defecation of the juice in the cells, the heat destroying all the unripe sugars or glucose, and changing the same into crystallisable sugars to a certain measure. The same process takes place when sour apples are roasted—they become sweet, or certainly less sour—why should not the roasting of cane be of a similar result? The annexed analysis shows conclusively that the albuminoids have been coagulated to a large extent, and that the juice passes out in a great deal purer state. The leaves, shoots, and all trash are burnt off during the roasting process, when otherwise they would carry juice with them, therefore a larger extraction of juice. The gum adhering to the outside rind of the canes is also mostly destroyed, and purer sugar must be the result.

"The evaporation of the water during the roasting of the cane is an economic feature which should not be overlooked: 18 per cent. of the original water in the cane being evaporated during the process.

"The bagasse only contained 3 per cent. of sugar, which, when figured down to the bulk of cane, is very small."

The analysis is as follows:—

1st. Cane as brought from the field 16 pounds. The seed weighed 3 pounds, the leaves weighed 2½ pounds—equals 5½ pounds; net weight of cane, 10½ pounds; weight of the cane after roasting, 9 pounds; evaporation by roasting, 1½ pounds, or 15 per cent.

2nd. Early Amber cane, new land:—

	Brix.	Sucrose.	Glucose.	Purity.
Before roasting	14· ..	8·7 ..	2·63 ..	59·59
After „	16·6 ..	10·8 ..	3·00 ..	65·06

Roasting increased the purity 5·47 on 59·59, or 9·2 per cent.

3rd. Early Amber cane on old land:—

	Brix.	Sucrose.	Glucose.	Purity.
Before roasting	17·00 ..	11·5 ..	3·00 ..	67·06
After „	19·2 ..	14·8 ..	2·70 ..	77·08

Roasting increased the purity 9·48 on 67·64, or 14 per cent.

This report of actual test corroborates the statement of that eminent authority upon sorghum, Prof. H. W. Wiley, Chief Chemist of the U. S. Agricultural Department. He says in a letter to Senator P. B. Plumb, of date of April 9th, 1889:—

"Dear Sir,—I have received your letter of April 8th, enclosing newspaper clipping describing the Adamson process of roasting the cane before expressing the juice. I have also received from the inventor a photograph of the apparatus which he proposes to use. I will state to you frankly what I think in regard to the process. Only two advantages could come from roasting the cane, viz.:—1st. A softening of the cane, which would render the subsequent pressure more effective. 2nd. A defecation of the juice in the cells of the cane before extraction.

"I think a previous roasting of the cane would tend to secure good results in both the methods mentioned above. Roasting the cane would render the substance of it softer, it would rupture the cells by the expansion of theliquid which they contain, and produce a general effect which would be comparable to that secured by using a first-class shredding machine, as is done on so many plantations in the South. It is estimated in the South that the gain in juice by using a shredder is fully five per cent., and I would say that in using a mill for expressing sorghum juice, fully as great a gain would be experienced by having the cane previously roasted.

"In regard to the second matter, I am also certain that roasting would produce a very fine defecation of juices. It would coagulate a large part of the albuminous matter, break up the tissues of the cane, and form a natural filter through which the juice would pass in a very pure state when subjected to a very severe pressure. Freezing has precisely the same effect, and I have noticed in expressing juice from cane which has been frozen, that the juice is remarkably pure and easily cured.

"The greatest advantage which I can see arising from the so-called roasting process would be in burning the waste from the cane and leaving it comparatively clear. The leaves and other matter adhering to the cane could be perfectly removed, and doubtless all the gum which is attached to the outside of the cane would be destroyed. My chief objection to the process would be on the score of economy; but I have not the least doubt of the fact that good sugar could be made in this way."

As by actual demonstration in erecting and operating the roaster it has been shown that it can be built at moderate cost, and that there is an abundance of the bagàsse to furnish fuel for the roaster and the mill also, it will be seen that the only objection urged by Prof. Wiley against this process is disposed of favourably to the roaster. The amount of water necessary for the operation of the roasting process is very small as compared to the diffusion process; the Minneola plant when in full operation not requiring more than could be supplied from an inch-and-a-half pipe, and the water was supplied from an ordinary dug well ninety-five feet deep. There are many localities in Western Kansas well adapted for raising a good quality of sorghum cane where sufficient water can be had to operate this process, but there could not be had sufficient to operate the diffusion process. Then the expenses for fuel amount to nothing, as the bagasse, after the plant has been in operation a day or two, furnishes more than sufficient for the entire plant. Thirty to thirty-five men are sufficient to operate this plant per day of twenty-four hours. Thus it will be seen that these plants can be erected and operated at comparative small expense, and in localities where diffusion plants cannot be successfully erected and operated.

If the sugar-making business is to be made a substantial success and benefit to the farming community, it must be brought within the reach of those who grow the cane. Cane cannot be profitably grown and hauled more than four or five miles, and two thousand acres of first-class cane will supply the largest mill in Kansas for a season's work. Then if these people are reached and given a benefit of a market for their cane, it must be by erecting plants of the roasting process; having a central factory with strike-pan, sugar-cars, and centrifugal, at the county seat, or some available point. Smaller plants may be erected in the outlying townships, not having these appliances, where syrup and mush sugar can be made and then hauled to the central factory to be finished by being run through the

strike-pan and centrifugals, thus giving work for the central factory for the greater part of the year instead of having to lie idle. That this arrangement of central and tributary plants is practicable and feasible, cannot admit of a doubt. These tributary plants could be profitably operated as well in connection with diffusion plants as any other.

In the erection and operation of these tributary plants a market is brought within reach of the farmer, as he can sell his cane nearer home; and in hauling the syrup and mush sugar from the central factory, many loads of cane are concentrated into one of the product, and while the country is new, the hauling of this product to the central factory will give employment to many persons and teams that would be otherwise unemployed. A good quality of sugar has been made at the Minneola plant the past season, notwithstanding the cane used was of an exceptionally poor quality, such as would not under ordinary circumstances be considered fit to make molasses, and the test of the process has demonstrated the fact that with a good quality of sugar-producing cane the roasting process is and will be a grand success. As was said before, we have no feeling of jealousy or opposition to the diffusion process; on the contrary, we wish it the grandest success. There is abundance of room for development of both processes without jealousy or interference of either with the work of the other. This is what we hope to see accomplished, and that at no distant day our beloved State of Kansas may be placed at the head of the list of sugar-producing States of the Union.

[It is only right to subjoin the following extract from the report of Mr. Kellogg, the State Sugar Inspector.—Ed. *Sugar Cane.*]

A matter of interest to the public, and especially to the people of southwest Kansas, is this question:—Is the Adamson roasting process a success? If not a complete success, has it reached such a degree of success as to warrant the voting of township bonds for the purpose of erecting new plants? First, I answer, this year witnessed the first attempt to manufacture sugar by this process on an extended scale. Whatever may be done in the future, it is a fact that up to the present time this process has not been demonstrated to be a success on a commercial basis. Secondly: While there is sufficient merit in the process to justify further experiment, in our judgment it would be unwise for the people to vote bonds for additional plants at this time.

CHEMICAL KNOWLEDGE APPLIED TO SUGAR PRODUCING IN QUEENSLAND.

(Continued from page 215.)

From all these experiments we shall in the course of time derive much benefit; but though there can be little doubt that by careful selection of cane and manure we can increase considerably the production of sugar per acre, still we can hardly hope that there can in a short time be any improvement in the sweetness of the cane at all corresponding with that obtained in Europe in a few years in beetroots. Sugar cane is one of those grasses which have been hitherto believed not to produce fertile seed, and as propagation is, therefore, effected by planting cuttings, no one has attempted to produce by selection of seed—as is done with the beet—that marked increase in saccharine content which is so much desired, and any improvement in this direction, if actually effected at all, by continually planting the sweetest canes, can only be gained by slow and painful steps. Fertile seeds have, however, been lately found by scientific observers in the West Indies and in Java; and, as their success in raising plants from such seeds will be emulated by hundreds of planters all over the world, it seems possible that we may now be on the threshold of an important change in our methods of propagating cane, and that we may have grounds for hoping that in the early future we may bring about a sensible improvement in the sweetness of sugar cane, which has not, so far as our knowledge extends, been as yet increased, even if it has not in some countries been diminished by the use of immature stalks for cuttings and by careless cultivation. To what extent the beet has been improved can be gathered from the fact that during the last twenty-five years its sweetness has been practically doubled, and that nearly 20 per cent. of pure sugar in the picked beets is not unusual, this increase being obtained by extreme care in the cultivating and manuring, but principally by the special selection of sweet beet for seeding, thus following the same line as that pursued by Mr. Hallett when raising the celebrated pedigree wheat which attracted so much notice a good many years ago. A good deal of attention is also paid by the chemists to the saving of what are usually called waste products. These play an important part in the manufacture of sugar from the cane. The crushed cane, after the obtainable sugar

has been extracted, is used for firing the boilers, and thus furnishes a very large portion of the fuel needed for working the factory; and this, too, serves a second purpose, as the ashes from it contain a good deal of potash and other fertilising substances which are needed for application to the fields from which the cane has been taken. Then, again, at all our factories the water driven off the juice of the cane while this is being boiled down is caught and used for watering the megass before it goes to the second mill, and for other purposes; and at our New South Wales mills, where fresh water cannot be obtained, it is fed into the boilers, which are thus both fed and fired with parts of the cane we buy. There is, however, one waste product for which yet but little use has been made; this is molasses, of which we make about 5000 to 7000 tons a year. Of this quantity we distil nearly half, and sell a small proportion for other purposes, but the balance is put on the fields as manure or thrown away. As it contains about 40 per cent. cane sugar and 10 per cent. to 20 per cent. glucose or grape sugar, it is a material of the greatest value for feeding stock, but so far we have not found it possible to make arrangements for disposing of it in any quantity. In the refineries also we effect some savings from the by-products by recovering sulphate of ammonia from the bone we distil for making the filtering charcoal, and the spent charcoal itself converted into superphosphate, the three important components of cane manure, ammonia, phosphoric acid, and potash, being to a certain extent provided by waste material of our own business. It could not be expected that changes in our methods such as have been here alluded to, and the general adoption of chemical control, could be carried out without some friction. Among even the strongest and most intelligent of our officers there was at first a hardly concealed scorn for the new-fangled notions and distrust of the chemist's work, but this has now entirely disappeared, and in every direction their reports are as a rule accepted without question and with confidence in their fairness and accuracy, and the help of the chemist is sought in many ways—here by a manager who wants to check waste in some branch of the manufacture, there by an agricultural overseer who wishes an analysis of the water he is using for irrigation, or advice as to the proportion of manure to apply to a field, or again by an engineer who asks for the analysis of the coal he uses or of the gases from a boiler flue in order that he may know if the setting of the boilers and the

arrangement of the firebars are those most conducive to the economical combustion of the coal. Having thus briefly sketched our system, I may say a few words about the financial results; and first, as to our expenditure, would state that we are now paying to the chemical staff and to those officers charged with the control of part of the manufacturing business, who possess a knowledge of chemistry, and have been chosen for those posts in consequence, some £8,000 to £9,000 a year in the shape of salaries and allowances for board, etc. There may be some doubt how we can be repaid for such expenditure, but any doubts on this point I do not in the remotest degree share. It would be almost impossible, even if it were necessary, for me to state exactly what is the value of the savings we have to set against such an expenditure, but among those in whose hands the general control of our business is placed, there is not a second opinion as to the money advantage of the chemical check; and when I say that saving 10 lb. or 12 lb. of sugar for each ton of cane—say, 5 per cent. of the weight of the cane—means to us £15,000 to £20,000 a year, and that an improvement in the colour of our refined sugar, which will bring us a few shillings per ton more for it, represents a similar sum, some idea can be gained of the ground on which the chemical staff has to work, and of the savings they can effect; and I may add that some of the losses in our manufacturing business have by their aid been reduced by one-third during the past four years, and the extent of this saving can be guessed by the fact that in one year the entire losses of sugar at our mills amounted to 14,000 tons, *i.e.*, the cane we crushed contained 14,000 tons more sugar than we were able to turn into marketable sugar. From the sum of such loss, it is easy to see that there are yet great possibilities in the manufacture of sugar from the cane, and in the cultivation of this crop much can still be done by manuring and thorough culture, even if the sweetness of the canes be not increased, as before suggested. We know now that on one plantation, in Java, the entire crop of cane has contained in one year as much as eight tons of sugar to the acre—the cane being about twelve months old—and when we bear in mind that the weight of an unusual crop of maize (eighty bushels), is two tons, and that a forty-bushel crop of wheat gives a total yield of one ton of grain and two tons of straw, some idea will be gained of the effect of tropical rain and sunshine in forming sugar in the cane when circumstances are favourable, and the cultivation and manuring are carefully

done under skilled supervision. It will be seen, moreover, that sugar cane occupies an exceptional position among other crops in the weight of marketable produce which can be extracted from it. And to the money benefits obtained by the chemical check we must add two more, both of considerable importance. The first is the great advantage of having in a large service like ours, a body of men of various ages, trained in the knowledge that their work is useless unless it is carried out with patient thoroughness, accompanied by uncompromising truth-telling. No chemist worth his salt dreams of concealing anything wrong, or twisting his conclusions so as to hide defects in the work of himself and others, and it is surely of great value to have an example of this sort always before the younger as well as the older men. To those who fear to confess a mistake, the certainty of its exposure acts as a useful tonic, while to all—from the top to the bottom of the staff—the example is wholesome. The second, is the mental refreshment and the increased interest in the work, due to the constant discussion of recorded facts and opinions, and of the experiments of the chemists.

Speaking for myself, I can say that I have frequently found that energy, flagging from the pressure of routine and other monotonous work, has again been roused by interesting reports of experiments or suggestions as to changes in our methods; and in the case of others, the constant competition between the officers, the chances offered in the interval between the seasons for independent research and the interchange of results, certainly produce healthful and useful interest in the work.

* * * * *

There only remains for me now to add the hope that the facts and opinions I have been permitted to bring before you may be of some use in showing how, by the employment of trained experts, the results from manufacturing and agricultural work can be improved and the losses which now occur may be reduced, and those products, now called waste, utilised,—which latter may in other industries—as in the manufacture of gas—be found of sufficient value to cause an enormous reduction in the expenses of manufacture.

(Concluded.)

VACUUM PAN WORK.

The Advantage of Continuous Charging.

Letter to the *Louisiana Planter*.

With all the promising efforts to improve which now characterize the laggard cane industry, one of the most important operations of the sugar house seems to pass unchallenged by that systematic investigation which has, none too soon, invaded all the other branches, or, if its apparent defects have attracted any serious attention, the fact so far as my knowledge extends has not been made public. I refer to the process of granulation, which probably needs a thorough examination as much or even more than any other.

What I am about to suggest upon this subject is so much at variance with long accepted ideas and usage that it will undoubtedly be met by the same prejudice which has opposed every innovation in the manufacture of tropical sugar, while forcing its way to general adoption. Nevertheless, the change proposed will, I think, stand the test of reason as it has that of practice so far as I have had occasion to try it in an empirical manner. To put the case as I understand it, more clearly, I will begin by inquiring upon what the present practice seems to be based.

Reviewing the antecedents of forced granulation, we find strong grounds for the assumption that it did not originate in any preconceived plan, or in the application of any theory based upon known principles of cause and effect, but was, on the contrary, like many other important discoveries, stumbled upon by mere chance, rendered possible by the introduction of the vacuum pan, which had been previously used solely for concentrating syrups to the crystallizing point (or in other words for making "string sugars"), and with no advantage beyond the reduction of the temperature of the boiling liquid.

The discovery of the possibility of utilizing Howard's invention for forcing the formation of grain in a state of ebullition, was to all appearance the result of a leaking charge valve, or of the negligence of some "pan man" who unwittingly "got grain" by charging the pan to its normal level, after the contents had, through carelessness, become dense enough to granulate. The imperfect grain thus casually formed was a revelation to some one concerned and induced a repetition of the process, until persistant trials established the present system. In refineries where it was developed, the pan was generally entrusted to uneducated men, often selected from the rank and file of the working

force—common labourers, in fact, who accepted without inquiry what was taught them, and the system, after the addition of a charging vessel to the pan to facilitate the operation by measuring the syrup, settled down to an accepted routine, whose adequacy no one thought of contesting. There is nothing that I am aware of in the history of sugar production or refining which controverts these suppositions and the belief that the present practice is neither more nor less than an empirical routine seems to be a fair inference.

Having deduced its probable origin, let us inquire what really takes place in the pan during the operation; commencing at the point where the nucleus of the future grain is fully formed, up to which stage the process is presumably correct. We now have the contents converted to a boiling mass composed of innumerable minute grains floating, each in its modicum of syrup, concentrated beyond the point of saturation in order to preclude their dissolution. This mass is boiled to a given density, and another addition of syrup made, to be again concentrated. The same operation is repeated throughout until the grain becomes large enough or the pan too full for its continuance.

What takes place in this building up of the grain may reasonably be supposed to be the following. The liquid with its suspended grains of sugar being heated from contact with the steam coils, becomes lighter and rises to the surface, carrying the solids with it. Emitting its steam and a part of its heat, its gravity increases again and it descends, each grain of sugar appropriating in its downward course a portion of the crystallizable matter surrounding it. This process of aggregation is repeated with more or less rapidity and apparently without intermission, augmenting gradually the size of the grain until the "strike" is completed.

We are, or at least believe ourselves to be, thoroughly acquainted with the factors which bring about this evolution, and they are—the natural tendency of saccharose to crystalize, a certain lowness of temperature, and a greater or less density. The counteracting influences include the presence of any matter not crystalizable, extreme heat and too low or too high a density.

In the light of this knowledge, however incomplete, plain common sense leads to the inevitable conclusion that there must necessarily be some specific combination of the favourable conditions which is most conducive to the end sought, and that, in the constant mutation maintained by the present spasmodic system of boiling by charges, the quantity of saccharose aggregated by the grains at each descent

must unavoidably be an ever varying one. In this irregular manner of supplying syrup, the margin is so wide in the influence of the one factor which is entirely under our control, that it must be pernicious, for all variations upon either side of some fixed point must each in its corresponding degree be prejudicial to the object in view; and by retarding the adherence of sugar to the grains prolong the inversion of sugar.

Upon the one side too much water in the cooking mass has a tendency to dissolve the grains and check granulation. Upon the other, too great a density will have a similar effect in retarding the increase of the grain from the fact that impurities prevent crystallization, and the denser the liquid the greater will be the proportion present, and consequently the greater their effect. There must therefore be some intermediate condition between the extremes attained immediately before and after charging, which leaves the grain most completely free to pursue its natural tendency to aggregation. It seems evident that to attain a maximum effect the density should be just about that of a thoroughly saturated solution of sugar at the same temperature as that of the boiling mass, but to avoid accidental melting it should for safety be kept a little higher.

So far then as deduction from the facts cited can be trusted as a guide, the practice of periodical charging should be abandoned for that of a continuous feed if we aspire to the highest result, and after the grain is once formed and hardened the syrup valve should never be entirely closed until the approximate termination of the "strike," but graduated to keep the contents of the pan just at that density which is most conducive to the aggregation of saccharose upon the grain.

I have never had an opportunity for making a systematic study of what really takes place during the operation, but have at different times cooked single strikes upon the principle I have endeavoured to elucidate, and have always found in the result a firmer and more even grain, with no risk of "gum" or "smear," nor false grain. The circulation was better (this is an important factor) and there was naturally less inversion, because granulation was more rapid, from the fact that the solid matters transmit little heat, and the *effective* heating surface of the coils is increased in the same proportion that the density is diminished.

Santiago Dod.

Roque, February, 1890.

HISTORY OF THE SUGAR CANE SEEDING IN BARBADOS.

In connection with the information on the subject of the experiments with regard to the propagation of the sugar cane from seed, made at Kew by Mr. D. Morris, which appeared in our April number, we now give the following details of the discovery, or possibly rediscovery, for which we are indebted to the *Demerara Argosy*:—In my former paper on "The Sugar Cane Breeding" published in these columns, I said in regard to the Barbados history of the subject that—"If the reports of the meetings of the Agricultural Society of the island, and files of the newspapers or agricultural correspondence of twenty years ago or more were looked up, doubtless additional information might be gathered. I suggest the research to any one on the island desirous of writing the local history, or of compiling a bibliography of the subject." Mr. J. B. Harrison, our Government Analyst, used the opportunity of his residence in Barbados to make this investigation, both by communication with planters of the period who are still living, and by looking through the files of newspapers of the time that have been preserved. The majority of the planters of that day have passed away, but fortunately one gentleman, Mr. James Parris, who took a leading and active part in raising seedling canes, still survives, and from memory and by reference to printed documents gave Mr. Harrison some of the desired information. Few of the facts and circumstances appear to have been placed on permanent record, and with the death of the older planters much information on the subject has been irrecoverably lost. In the floating traditional knowledge, which is general among the present generation of planters on the island, there is proof that raising the sugar cane from seed had been practised and was well known to their fathers, though its potential importance was not recognised, and its utility was, after a short experience, disbelieved in; the whole of the plants that were raised being destroyed or allowed to perish. It was this floating tradition of which I have spoken, that led, in carrying out cultural experiments at Dodd's Botanical Station, to the rediscovery of natural seedlings, and from the publicity given to this re-discovery the present interest in the subject has grown. I now extract from the report of Messrs. Harrison and Bovell on the work at Dodd's Station for last year, the following narrative of the recorded notices that appeared thirty-one years ago in the Barbados papers,

the oral information gleaned from men of that period still living, and the account of their own re-discovery of seedlings in 1888, and the experiments carried out at the Station since :—

EXPERIMENTS IN RAISING THE SUGAR CANE FROM SEED.

Attention here was first strongly directed to this point in 1859 by the Honourable J. W. Parris, who succeeded at his estate, Highlands, in St. Thomas' parish, in rearing successfully self-sown seedlings; and, in order that credit should be given to the pioneer in this branch of research, we have obtained the account given by Mr. Parris in a local newspaper, in 1859, of his discovery, which is below reproduced, with two other extracts from the press.

The Barbados Agricultural Reporter, March 8th, 1859, said :—

"In transferring to our columns the following remarks and letter from the *Liberal*, we cannot refrain from congratulating the country on there being found at last a planter who has overcome the reluctance of the race to figure in print. In reference to what Mr. Parris states as to the varieties of canes growing in the same field, to which he seems to attribute the fact of having seedlings of three sorts, we would remind our readers that it is no uncommon thing for different varieties of seedlings to be produced from the same stalk. It is indeed by propagating from seed that the endless variety of roses, to say nothing of other flowering shrubs, has been obtained, and the sweet potato has been known by actual experience to give from the seed of one slip many kinds which were either previously unknown, or of which no trace was to be found in the field in which the parent grew. So also it is notorious that the rind fruits are most uncertain when grown from seed, a Royal Family Shaddock perhaps degenerating into an article more fit for the punch-bowl than for the dessert service, and therefore it is always considered necessary to propagate such trees by off-shoots from the root.

The Liberal, February 12th, 1859, said:—

"A discovery appears to have been made last year at Highland Plantation in the parish of St. Thomas, the practical importance of which, should circumstances tend to verify it, can scarcely be overrated in an agricultural point of view. It appears that sometime about the month of May, the Superintendent found growing in a field of canes that had been kept for ratoons, several grass-like plants, the unusual appearance of which in the field led him to examine them

closely, and he came to the conclusion that they were canes growing from seed—the seed, as he surmised, having been thrown out from the cane arrows of the previous crop. He communicated the fact of his finding these plants and his views respecting them to his master, Mr. James Parris, who, at first, was rather disposed to ridicule the idea, but eventually saw reason to change his opinion. The matter having come to our knowledge in somewhat general terms, a week or two ago, we communicated with Mr. Parris on the subject, who was kind enough to afford us in conversation all the particulars connected with the discovery, and has since, at our request, embodied them in the following letter, which we doubt not will be read with much interest, especially by persons interested in the cane cultivation in these colonies. The plants which Mr. Parris succeeded in raising did not arrow last year, and he proposes taking plants from them for a fresh planting this year, and keeping the stools to ratoon, the better to ensure the chance of some one or more of them giving seed, if it be in their nature to do so under the circumstances.

Mr. J. W. Parris, to the Editor of *The Liberal.*

"In accordance with your request, I now send you the following particulars regarding the canes established from the seed, and which are now growing on Highland Plantation.

"I think it was somewhere in the month of May last year, that my attention was called to the fact of there being several cane plants growing in a field of ratoons, which the Superintendent pronounced as having grown from ths seed of the cane arrow. On first examination, I thought it was a mistake, they bore so close a resemblance to guinea grass when it grows from seed; but as there was not any of this kind of grass growing on or near the field in question, I could not account for its presence there, and this circumstance caused a stricter examination on my part, the Superintendent all the while declaring positively that they were veritable canes. After being satisfied myself that they were really canes, I caused all that could be found to be removed and transplanted to another field, but in consequence of the weather being very dry I could only save seven plants of them, and these are now alive and are growing. I intend having the plants from those put in a spot by themselves this year, hoping to obtain seed from them again.

"The field on which they grew is in that part of the estate which runs down a hill into Scotland; the soil is very moist and is com-

posed of clay, siliceous sand, and chalk, and had been the year previous thoroughly tilled and was in what we planters call fine heart, that is in a finely divided and pulverised state. The parent canes were very vigorous, and there were several varieties growing together in the field. It appears as if there are seed from three kinds growing—the Bourbon, Transparent, and Native; that is the plants which are growing have the appearance of these at present. I would also remark that these plants were not found growing in one spot but were scattered over a space of more than half an acre, and grew up wherever the trash did not cover the land thickly. Any further information that you or any other gentleman might require concerning the above, I shall be most happy to afford, as far as I am able, or to shew the plants as they now stand.—Glendale, February 8th, 1859."

Further Testimony.

"Mr. Parris has recently stated to us that he finally succeeded in planting four and a half acres with canes raised from these original seedlings, and that he estimated their yield of sugar at over four hogsheads to the acre. He however, from what he regarded as certain objectionable characteristics which arose in the canes, finally abandoned their cultivation, and did not again turn his attention to the subject. In order to test the truth of Mr. Parris' discovery of cane seedlings, several persons here immediately afterwards attempted to raise them from the cane arrows. This was done successfully by Mr. Carter of Bridge Cot, and by Mr. J. Wiltshire Clarke, neither of whom however appeared to have attached much importance to the results. At another time Mr. T. Clarke, of Cane Field, discovered cane seedlings growing from a fallen cane arrow, but did not succeed in raising them, and Mr. E. S. Sisnett found some cane seeds growing in Christ Church about the year 1861; these were allowed to grow amongst canes that were planted in the usual way, but as they were very small and thin when they reached maturity they were destroyed. In this last case the seeds appear to have come from the Bourbon canes. Next we find that the late Mr. W. Drumm paid much attention to this subject, and wrote several letters to the *Sugar Cane* upon it. He however stated to us in March, 1884, that whilst he had repeatedly obtained cane seed he had never succeeded in raising canes from it, and that he believed the various instances we have mentioned to be errors of observation."

THE RECENT EXPERIMENTS.

"At Dodds the cultivation of the different varieties of canes in large numbers and side by side has placed us in a specially favourably position for examining into this question. In January, 1888, Mr. J. B. Pilgrim, one of the overseers at Dodds, reported to us that in the neighbourhood of one of the experimental fields he noticed that certain fine grasses were springing up, and we found at intervals from then to the middle of March similar seedlings. These were found not only on the surface of the field but also growing in the bottom of a somewhat deep drain which had been recently dug. Much difficulty was experienced in preserving these seedlings, as they were exceedingly sensitive to the effects of exposure to the sun or wind. In June, 1888, the seedlings which had survived were transplanted, giving us about 60 plants. Certain of them were dug up with great care and placed in water until the soil crumbled away from their roots and were carefully examined for any traces of cane that might be on the roots. Nothing could be detected, and we were strengthened in an opinion that they were true seedling canes by the very great difference in their mode of growth from that of canes growing from the eyes of canes. A few months later we found that there were several distinct varieties amongst them. In December, 1888, we examined them with great care and grouped them into ten groups according to their most strongly marked characteristics, and found that in many of our groups thus formed the canes graduated from one group into another. Many of these canes exhibited some of the characteristics of certain of our varieties, together with the characteristics of other varieties, but in some cases we could not even form any opinion as to their parentage as they differed completely from any canes we had ever seen. During the latter stages of their growth these canes were examined by many planters and sugar chemists, all of whom were particularly struck with the amount of variation they exhibited, and with the fact that certain of them were entirely different from any canes they had previously seen. The canes as grouped were replanted in the usual manner and are now in course of experimental cultivation. The remaining canes were reaped on March 8th, 1889, and fifty plants yielded 307lbs. of cane tops, and 1,626 lbs. of canes, which gave 61% of juice of a density of 10·6°. Beaumé containing 1·629 lbs. of sucrose and ·090 lbs. of glucose in the imperial gallon. The following are the compositions of the canes, cane juice and megass:—

	Canes.		Cane Juice.		Megass.
Water	68·11	....	81·18	....	48·20
Sucrose	12·62	....	15·13	....	8·70
Glucose	·61	....	·83	....	·48
Ash	·47	....	·30	....	·75
Albuminoids	·33	....	·17	....	·59
Fibre	15·44	....	..	....	39·60
Organic Matters....	2·34	....	2·39	....	1·68
	100·00		100·00		100·00

"In order to definitely settle the question of whether the sugar cane produced fertile seed, from the middle of December, 1888, to that of February, 1889, most careful search was made through the fields for growing seedlings and for arrows containing fertile seed. The search for both of these proved successful, but only on the fields in which the varieties were growing and on which, as pointed out by us in our 1888 report, the conditions for fertilisation are most favourable. The seedlings as found were transplanted into boxes, but on account of the unfavourable climatic conditions, great difficulty was experienced in preserving them; on one occasion an accidental exposure to the sun for about three hours destroyed five out of seven contained in the exposed box. One seedling was found attached to a portion of cane arrow which had fallen in a damp and sheltered position. The portions of cane arrows found, which apparently contained fertile seed, were collected, the apparent seeds carefully separated from the spikelets of the panicles, and sown at intervals commencing on January 12th. Ten days after some of the seeds were seen to be germinating, and certain of them were removed and preserved as microscopic objects. Of the apparent seeds, less than five per cent. germinated, and not more than one-fourth of the germinated ones finally survived.

"As the self-sown seedlings and those raised from the seeds by ourselves, reached a sufficiently advanced stage of growth (the exceedingly slow growth of the seedlings at an early age is most marked, a point which in certain previous researches may have prevented the attainment of complete proof of the fact that the sugar cane produces fertile seed, and in which mode of growth the seedlings strikingly differ from the rapid growth of canes from the buds) they

were similarly to the seedlings of 1888 transplanted into the field, and are now in course of experimental cultivation.

"As far as our experience at present shows, the conditions most favourable for the production of fertile seed by the sugar cane are found in the cultivation of varieties side by side, and in comparatively large numbers, although from observations recently made, apparently fertilised ovules are to be found from time to time upon arrows of Bourbon canes growing by themselves. To secure the germination of the seeds it is necessary to sow them soon after the arrow ripens under similar conditions to those necessary with the seeds of other of the gramineæ of low germinating power.

"The fertile seeds enclosed in the glumes are long and narrow, being from 3 to 4 millimetres in length and ·65 to ·70 millimetres in breadth, and terminate in a beard from 6 to 8 millimetres long."

AGRICULTURE IN FIJI.

(From a correspondent in *The Queenslander.*)

The sugar industry, which may fairly be considered as the mainstay of the colony, is at the present time in no very flourishing condition. True, the late ruling high prices gave things for the time a slight spurt, but they have again fallen back to their old level. The New Zealand Mortgage and Agency Company's mill at Ellington, on the Ra coast, has ceased crushing; but it has been decided that if next year's operations are not a decided improvement on former years, the mill is to be closed permanently. This is one of the last small establishments which have struggled so hard in face of adverse times, and it is deplorable to think how many properties once in flourishing circumstances have lately gone to the wall. Some years ago the estate of Messrs. Sharpe, Fletcher & Co. passed into the hands of the Union Bank of Australia, who put a caretaker in charge and allowed the property to be idle. Then the Holmhursh mill, on Taviuni, was closed, and only last year the valuable estate of the Mago Island Company fell into the hands of the mortgagees. We now hear that the company who may fairly be entitled the founders of the sugar industry on the Rewa River, under the style of the Rewa Sugar Company, are allowing their mill and extensive estate

on the Rewa River to fall under the hammer. This first mill at Ulicalia, on the Rewa, was, not so many years ago, the centre of an industrious population. All round them small planters had taken up holdings and were busy growing cane to supply the rollers. They made no great promises; they held out no offers of large bonuses to their constituents, only paying them fair remunerative prices for their produce, and both were seemingly well satisfied with their bargain, and the company were making money fast. This was in the good old days. Eight years ago they endeavoured to increase their own canefields in their immediate vicinity, but the land was so crowded that they found it necessary to go further afield. This they did in 1886, when they opened their large mill at Koroni-Via, with all the latest improvements for simplifying the process of manufacture and obtaining the best results. They have carried on business here ever since up to the present time, and now it appears they find it impossible to carry on any longer, and intend giving up. Their former constituents had for many years left them, lured, doubtless, by the fine promises of the larger company. Of these I will now give a short sketch. In the year 1882, fifteen planters and landowners on the Rewa entered into a contract to grow a certain number of tons of cane, for a term of ten years, to supply the mill belonging to the Colonial Sugar Refining Company, and out of these fifteen only seven can now be found who still continue to supply any cane at all, although their contracts have yet two years to run. Not one of these seven have an area of 100 acres of cane left; they are finding a means of support by growing food, bananas, and by dairy farming. Four of the largest holders, who had areas varying from 800 to 200 acres growing cane exclusively for the company, have now been forced to relinquish even their estates, and these have now passed into the company's hands, and are being worked by them. Having become the owners of all the best sugar estates, the company are now competing with the remaining planters by turning some of their sugar fields into banana plantations, and swamping the local market by transporting their fruit by the means already to their hand (having steamers and punts, ordinarily used in their legitimate business of transporting cane), and selling it at low rates. It is to be feared that this system will eventually ruin the fruit trade of Fiji in the colonial market, as they often ship an inferior article and sell at low rates.

Correspondence.

TO THE EDITOR OF "THE SUGAR CANE."

Sir,—I think you would do good service to the cane sugar industry if, in your next issue of the *Sugar Cane*, you would give a tabular statement of the rates of duty charged by the United States on sugar imported from our West Indian colonies. Sir James Fergusson's reply to Mr. Watt's question, in the House of Commons, as to the amount of duties charged by the United States on West Indian sugars makes such a statement desirable. The baronet said that he understood the duty practically amounted to £6 10s. per ton. I think you will find that the duty charged on sugar equal to the Dutch standard of No. 13 is between £9 and £10 per ton. There is an advancing extra duty on sugars beyond that standard. This ultimately becomes so heavy that the better qualities of sugar cannot be imported at a profit. The higher qualities of vacuum pan sugars are virtually prohibited from the United States market by reason of the excessive duty. Considering what a bulky article sugar is, it is strange that the Government of the United States do not see the advantage that their trade would derive from allowing sugar to enter their ports duty free. Consider what an increased consumption would immediately take place if there were no duty on the article. Such increased consumption would necessitate increased tonnage to bring the wanted increased supply to the market. The article being bulky would necessitate a very large increase in the tonnage. More rope, more chains, more anchors, more canvas, more sailors would be required. The sailors would require boots, trousers, clothing of all kinds, and bedding. Consider what an impetus all these requirements would give to the several trades. Nor have I yet enumerated all the advantages.

More porters would be required to unload the vessels, more would be required to store it in the warehouses, more to unstore it when it was wanted. More carts and waggons would be necessary to carry it to the several railway stations for distribution through the country. There would be more traffic for the railways. Finally, there would be a larger and more regular demand for warehouse room, thus giving a better and more certain rent to such property.

I am, yours, &c.,

W. H. JONES.

2, Vermont Road, Upper Norwood,
13th April, 1890.

EXTRACT FROM THE UNITED STATES TARIFF.

Schedule E.—Sugar.

All sugars not above No. 13 Dutch standard in colour shall pay duty on their polariscopic test as follows, viz:—

All sugars not above No. 13 Dutch standard in colour, all tank bottoms syrups of cane juice or of beet juice, melada, concentrated melada, concrete and concentrated molasses, testing by the polariscope not above seventy-five degrees, shall pay a duty of one and forty-hundredths cent per pound, and for every additional degree or fraction of a degree shown by the polariscopic test, they shall pay four-hundredths of a cent per pound additional [*a*. Provided, That concentrated melada, or concrete, shall hereafter be classed as sugar * * * and melada shall be known and defined as an article made in the process of sugar-making being the cane-juice boiled down to the sugar point and containing all the sugar and molasses resulting from the boiling-process and without any process of purging or clarification, and any and all products of the sugar-cane imported in bags, mats, baskets or other than tight packages shall be considered sugar and dutiable as such. And provided further, That of the draw-back on refined sugars exported allowed by section three thousand and nineteen of the Revised Statutes of the United States, only one per centum of the amount so allowed shall be retained by the United States. Act of March 3, 1875, sec. 3.]

All sugars above No. 13 Dutch standard in colour shall be classified by the Dutch standard of colour, and pay duty as follows, viz:

All sugar above No. 13 and not above No. 16 Dutch standard, two and seventy-five hundredths (3.4375) cents per pound.

All sugar above No. 16 and not above No. 20 Dutch standard, three (4.0625) cents per pound.

All sugars above No. 20 Dutch standard, (5 cents,) three and fifty-hundredths cents per pound.

Molasses testing not above fifty-six degrees by the polariscope, shall pay a duty of four cents per gallon; molasses testing above fifty-six degrees, shall pay a duty of eight cents per gallon.

Sugar candy, not coloured, five (10) cents per pound.

All other confectionery, not specially enumerated or provided for in this Act, made wholly or in part of sugar, and on sugars after being refined, when tinctured, coloured, or in any way adulterated, valued at thirty cents per pound or less, ten (15) cents per pound.

Confectionery valued above thirty cents per pound, or when sold by the box, package, or otherwise than by the pound, fifty (50) per centum ad valorem.

THE PROPOSED SUGAR TARIFF.

The sugar schedule in the bill as completed by the Committee on Ways and Means, is as follows:—

Schedule E.—Sugar.—All sugars not above No. 16 Dutch standard in colour, all tank bottoms, all sugar drainings and sugar sweepings, syrups of cane juice or of beet juice, melada, concentrated melada and concrete, and concentrated molasses shall pay a duty of 35 per cent. *ad valorem.*

All sugars above No. 16 Dutch standard in colour shall pay a duty of 40 per cent. *ad valorem.*

Molasses testing above 56 degrees by the polariscope, 25 per cent. *ad valorem;* provided that if an export duty shall hereafter be laid upon sugar or molasses by any country from whence the same may be imported, such sugar or molasses so imported shall be subject to duty as provided by law prior to the passage of this Act.

Sugar candy and all confectionery, including chocolate confectionery, made wholly, or in part, of sugar, valued at 12 cents or less per pound, and on sugars after being refined, when tinctured, coloured, or in any way adulterated, 5 cents per pound.

All other confectionery, including chocolate confectionery, not specially provided for in this Act, 50 per cent. *ad valorem.*

Glucose, or grape sugar, three-fourths of one cent per pound.

And on the free list is placed:—

Molasses testing not above 56 degrees by the polariscope, provided that if an export duty shall hereafter be laid upon molasses by any country from whence the same may be imported, it shall be subject to duty as provided by law at the date of the passage of this Act.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. THOMPSON, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

4404. F. MAY, London. *Improvements in moulds for use in the manufacture of sugar in lumps, tablets, or other pieces.* 20th March, 1890.

4513. J. DUNCAN, London. *Improvements in the treatment of molasses or syrup obtained from beetroot.* 22nd March, 1890.

4562. J. COPPARD, London. *Improvements in the construction of appliances for extracting the juices from fruits and other substances.* 24th March, 1890.

4754. A. J. BOULT, London. (Communicated by Leopold Bon, Cuba.) *Improvements in or relating to apparatus for drying sugar cane trash.* Complete specification. 26th March, 1890.

4802. G. C. TOPP, London. *Improvements in hydrometers, saccharometers, and lactometers.* 27th March, 1890.

5282. G. F. REDFERN, London. (Communicated by Moriz Weinrich, United States.) *Improvements in washing and cleaning raw sugar.* April 5th, 1890.

5283. G. F. REDFERN, London. (Communicated by Moriz Weinrich, United States.) *Improvements in the manufacture of sugar.* April 5th, 1890.

5329. E. L. DEHAN, London. *An approved apparatus for retaining the fluidity of melted sugar and the like used in confectionery.* April 8th, 1890.

ABRIDGMENTS.

1282. 1890. C. D. ABEL, London. (Communicated by Messrs. Pfeifer and Tangen, of Cologne, Germany.) *Improved treatment of sugar crystals or grains for facilitating the purifying or washing thereof.* January 24th, 1890. Chiefly applicable for the treatment of close grained masses of sugar. Raw sugar is treated by a preliminary heating and then cooled. Masse-cuite is treated by being pressed into blocks, then cut into lumps or sticks, and finally treated as above. This operation gives the mass a greater power of resistance to the passage of the washing liquor.

7517. 1889. G. ADANT, of 21, Rue Manchester, Brussels. *Improvements relating to the manufacture of sugar.* May 14th, 1889. This invention relates to the manufacture of sugar in the form of blocks, slabs, or bars; and is designed to improve the construction of the apparatus set forth in Patent No. 13084, 1888. The modifications comprised under this invention enable the manufacture of the blocks, slabs, or bars of sugar to be effected with greater rapidity and certainty, the removal of these blocks, slabs, or bars from the apparatus being rendered easier, as they present themselves edgewise in the modified apparatus instead of flat as in the apparatus described in the above-mentioned specification. The working of the sugar may be effected by means of steam.

AMERICAN.

ABRIDGMENTS.

416107. J. W. HYATT, of Newark, N.J. (assignor to the American Extractor Co., of same place.) *Process of making extracts.* November 26th, 1889. This process is specially applicable to the extraction of saccharine from disintegrated sugar yielding plants. A plunger reciprocates in a chamber, and at each stroke a portion of the fibre to be treated is fed in by a suitable hopper. These gradually accumulate and form a plug. The plug is compressed partly by reason of its frictional contact with the walls of the chamber and partly because at the end of it remote from the plunger is a body of liquid (water) kept under a suitable pressure by means of valves, &c. This liquid is constantly being displaced by the fresh increments of fibre, and is forced to percolate through the plug towards the plunger through which it escapes by means of suitable perforations or channels. The liquid in its passage through the fibre dissolves all the soluble matter which may be treated as desired.

416108. J. W. HYATT, of Newark, N.J. (assignor to the American Extractor Co., of same place). *Apparatus for the continuous extraction of fluids.* November 26th, 1889. Apparatus for carrying out a process similar to that described above. The liquid pressure is obtained by means of a column of suitable height open at top to the outer air. The refuse bagasse may be removed from this column by means of elevators, &c.

420121 A. BAUMGARTH, of Sudenberg, Magdeburg, Prussia, Germany. *Apparatus for refining sugar.* January 28th, 1890. The object of this invention is an apparatus for refining sugar by means

of the application of an atomized jet or spray of water, or blueing material and water, and the mechanism shown and described allows of the jet being automatically regulated and applied to every part of a mass of raw sugar contained in a centrifugal machine. The chief advantages of the invention appear to be, the trifling cost of the application and small dissolution of sugar.

420749. L. W. TRACY, of New York, Assignor of two-thirds to J. E. Granness, of same place. *Evaporating apparatus.* February 4th, 1890. This invention comprises certain devices and heating tubes or pipes, such as are used in carrying out the process described in a prior application filed on August 31st, 1888. The object of the present improvements is to cause a more even and regular feed over the surfaces of the steam-heated pipes which are used as evaporating surfaces. These pipes or tubes are roughened or corrugated externally to prevent the liquor from flowing along them, and running off in streams at different points. By the present improved construction the liquor is caused to fall in drops along the whole length of the pipe on to the pipe next below, and thus an even distribution is obtained.

421163. W. H. COLLINGS, of Collingswood, New Jersey. *Vacuum evaporator.* February 11th, 1890. This invention relates to "in transit" evaporators, and one of its novel points consists in the use of evaporating tubes, which are diamond shaped in cross and section.

421523. J. T. DORE, of Bayou Sara, Louisiana. *Revolving bucket strainer.* February 11th, 1890. A straining wheel with a broad perforated periphery is provided with a series of flap-like "buckets," which when said wheel revolves is pressed against it by reason of passing under a fixed roller. The bagasse is placed between the buckets and wheel and is thereby compressed, the juice being forced through the perforations.

422083. H. W. LAFFERTY, of Wilmington, Delaware. *Centrifugal machine.* February 25th, 1890. A conical perforated basket surrounds a similarly shaped inner case, the apex of each pointing downward. Material is fed in between them, and they are revolved together. The liquor escapes through the perforations, while the solid matter is driven out over the top of the basket into a surrounding trough. Retarding devices are employed (such as wire brushes, etc.,) to prevent the solids from leaving the basket too quickly.

422234. S. M. LILLIE, of Philadelphia, Pa., U.S.A. *Condenser with multiple effect evaporating apparatus.* February 25th, 1890. A

spray condenser is used to condense the vapours arising from each effect. The water is first used (in form of sprays), to condense the vapour from the last or coolest effect, and is then led to the next hottest one, and so on throughout the series. Various details of construction are described.

422235. S. M. LILLIE, of Philadelphia, Pa. *Evaporating Apparatus.* February 25th, 1890. A series of horizontal tubes is fed with steam and the liquor to be treated flows over their outer surfaces. The tubes are closed at one end, the said end being perforated with a minute orifice to allow gases or air to escape. Circulating and exhaust apparatus are connected to the evaporator which may be multiple effect if desired.

423408. D. H. BENJAMIN, of Utica, New York, assignor to E. Hurlburt, of New York. *Centrifugal Machine.* March 18th, 1890. A vertical shaft carries the basket upon its upper end, the basket revolving inside an annular casing which catches the expressed liquor. The bottom of the shaft rests in a ball or universal joint, and at a point between this and the basket a loose collar surrounds the shaft, and is connected with standards or fixed supports by springs and links. This construction allows the basket to accommodate its position while revolving, according to the centre of gravity of its contents.

423869. J. W. HYATT, of Newark, N.J., assignor to the American Extract Company, of Newark, N.J. *Apparatus for making fluid extracts.* March 18th, 1890. Improvements in previous patents for obtaining extracts by the action of a pervious plunger which forces the material under treatment through a body of water, in a series of compressed superimposed plugs, and the present inventions chiefly relates to details of construction of the apparatus for a proper understanding of which the drawings are indispensable.

423930. H. A. HUGES, of Rio Grand, New Jersey. *Process of diffusion for sorghum cane, &c.* March 25th, 1890. Improvements on patent No. 402083 to prevent the masses of shredded cane from absorbing the water on other liquid from the battery cells. Each lot of shredded cane is steeped in an independent cell, containing sugar liquor which has been obtained from a previous operation.

GERMAN.

ABRIDGMENTS.

49248. P. BÖGEL, Breslau. *Apparatus for the production of powdered caustic lime from lime powder.* 13th March, 1889. This

apparatus is for use in the process for separating the molasses, that is to say for precipitating the sugar from the molasses by means of pulverised lime, and is specially useful for slacking caustic powdered lime with atomised water or water spray. A shaft provided with rotary stirrers, rotates in a conical drum which reduces the pulverised lime to a very fine powder, water in the drum is at the same time atomised by means of a well-known apparatus in which compressed air is used. Very fine pulverised hydrate of lime is thus produced, which is at once added to the diluted molasses for the purpose of separating the lime sugar.

49854. ZULIUS SCHWAGER, Berlin. *Extraction of vapourised bodies of low boiling point by repeated application of heat.* 20th December, 1888. In order to obtain the substances of low boiling point formed in the condenser by means of cooling or absorption apart from the evaporation in the evaporating systems, the gases which are not condensed in the heating spaces, and the vapourised particles of low boiling point are drawn off into special cooling vessels, or direct to the air pump avoiding the evaporating condenser.

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, April 10th, 1890.

FAIR REFINING.	96o/o CENTFS.	GRANULATED.	STAND. A.	STOCK IN FOUR PORTS.
April 10, 1890.—4 13-16c.	5⅜ 7-16c.	6-6 1-16c.	5¾c.	Jan. 1, 1890— 11,169 tons.
April 11, 1889.—5 13-16-⅞	6¾c.	8c.	7¾c.	Jan. 1, 1889— 32,254 tons.
April 12, 1888.—4 13-16c.	5½c.	6¾-13-16c.	6¼c.	Jan. 1, 1888— 47,798 tons.
April 14, 1887.—4 9-16c.	5⅛c.	5¾c.	5⅝c.	Jan. 1, 1887—102,279 tons.
April 15, 1886.—5 1-16c.	5¾c.	6⅜-7-16c.	6 1-16c.	Jan. 1, 1886— 57,328 tons.
April 16, 1885.—4 9-16c.	5¼c.	5 15-16c.	5½c.	Jan. 1, 1885— 89,186 tons.
April 10, 1884.—5⅝c.	6 5-16c.	7c.	6⅝c.	Jan. 1, 1884— 60,900 tons.
April 12, 1883.—7c.	7 11-16c.	8 11-16c.	8 3-16c.	Jan. 1, 1883— 50,297 tons.
April 13, 1882.—7½c.	8 9-32c.	10c.	9⅝c.	Jan. 1, 1882— 43,927 tons.
April 14, 1881.—7 3-16c.	8c.	9 5-16⅜c.	8⅞-9c.	Jan. 1, 1881— 66,999 tons.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO MARCH 31ST.

Board of Trade Returns.

IMPORTS.

RAW SUGARS.	QUANTITIES.		VALUE.	
	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Germany	1,548,213	1,462,750	1,072,417	848,763
Holland	93,990	110,874	62,105	59,643
Belgium	345,320	317,494	213,050	160,544
France	24,067	657,951	15,786	401,709
British West Indies & Guiana	615,195	370,100	518,999	287,373
British East Indies	56,964	52,670	30,581	23,019
China and Hong Kong	....	....	....	....
Mauritius	20,883	773	14,144	487
Spanish West India Islands	34,000	....	28,050	....
Brazil	363,487	93,396	235,874	55,491
Java	283,168	150,242	239,657	119,245
Philippine Islands	64,705	35,600	31,674	17,435
Peru	165,086	227,556	121,038	155,038
Other Countries	190,620	98,451	133,188	69,986
Total of Raw Sugars	3,805,698	3,577,857	2,716,563	2,198,733
Molasses	47,292	29,288	17,137	11,141
Total Sugar and Molasses	....	....	2,733,700	2,209,874
REFINED SUGARS.				
Germany	1,089,984	1,105,050	959,347	895,954
Holland	374,684	413,428	342,662	344,305
Belgium	73,354	43,257	69,669	38,945
France	339,700	770,600	302,442	619,915
United States	7,565	377	6,460	696
Other Countries	*323,440	98	*270,817	73
Total of Refined	2,208,727	2,332,810	1,951,397	1,899,888

EXPORTS.—REFINED SUGARS.

	Cwts.	Cwts.	£	£
Sweden and Norway	23,576	19,827	17,747	14,158
Denmark	33,025	25,198	24,353	14,863
Holland	23,252	20,798	16,519	14,771
Belgium	7,024	6,569	4,632	4,471
France	3,908	3,021	2,739	1,922
Portugal, Azores, & Madeira	21,016	24,124	14,976	15,501
Italy	22,248	24,832	16,860	16,302
Other Countries	38,010	49,140	29,909	37,103
Total of Exports	172,059	173,509	127,735	119,091

* Imported almost entirely from Russia.

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of March, 1890, compared with the corresponding month of the two preceding years, and the average monthly imports for the past year compared with those of 1886, 1887, and 1888, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				Mar.	Mar.	Mar.	Monthly Average.				Mar.	Mar.	Mar.	Monthly Average.				Mar.	Mar.	Mar.
	1886	1887	1888	1889	1888	1889	1890	1886	1887	1888	1889	1888	1889	1890	1886	1887	1888	1889	1888	1889	1890
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France.............	1462	1363	1686	2373	1902	2093	3946	2688	5099	4855	8595	1177	2950	6019	4150	6462	6541	10969	3079	5043	9965
Holland	3508	3780	3267	2294	1634	3578	2836	1428	2483	2675	3354	2108	3708	4242	4936	6263	5942	5648	3742	7286	7078
Germany & Austria ..	990	1347	1510	2573	1267	3057	2549	6634	10463	11729	13844	4114	12913	16211	7624	11810	13239	16417	5381	15970	18760
Belgium	344	592	622	827	1053	1343	442	113	308	227	225	241	205	225	457	900	849	1052	1294	1548	667
United States	854	454	8	..	23	..	..	5078	2804	157	42	24	111	5	5932	3258	165	42	47	111	5
Russia.............	..	3	..	23	..	..	..	3412	452	1959	2015	3906	5386	..	3412	455	1959	2038	3906	5386	..
Other Countries	..	..	1	239	..	..	..	9	15	2	355	..	28	..	9	15	3	594	..	28	..
Total	7158	7539	7094	8329	5879	10071	9773	19362	21624	21604	28431	11570	25301	26702	26520	29163	28698	36760	17449	35372	36475

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

TO APRIL 19TH, 1890 AND 1889. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS.		DELIVERIES.		IMPORTS.	
	1890.	1889.	1890.	1889.	1890.	1889.
London	31	32	85	86	68	86
Liverpool ..	61	75	88	96	63	75
Clyde......	47	43	66	74	74	96
Bristol	1	2	22	21	19	19
Total ..	140	152	261	277	224	276
	Decrease..12		Decrease..16		Decrease .. 52	

The above figures do not represent accurately, or to the full extent, the position or movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Circular.)

FOR THE FOUR PRINCIPAL PORTS. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND. FOR MARCH, 1890 AND 1889.

	STOCKS. April 1st.		DELIVERIES. In March.		IMPORTS. In March.	
	1890.	1889.	1890.	1889.	1890.	1889.
New York	9	19	64	71	69	56
Boston	..	2	16	6	13	6
Philadelphia....	..	..	23	32	23	32
Baltimore	..	..	..	..	..	..
Total......	9	21	103	109	105	94
	Decrease.. 12		Decrease.. 6		Increase .. 11	
Total for the year			293	242	290	231

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 31ST MARCH, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	German Empire.	Austria.	Remaining four principal *entrepôts.*	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
144	270	57	400	210	30	1111	734	857

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST MARCH, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	German Empire.	Austria.	Remaining four principal *entrepôts.*	TOTAL 1889-90.	TOTAL 1888-89.	TOTAL 1887-88.
1313	481	46	431	265	357	2893	2818	2620

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.	1886-87. Tons.
German Empire	1,260,000	990,604	959,166	1,012,968
France	800,000	466,767	392,824	485,739
Austria-Hungary	750,000	523,242	428,616	523,059
Russia	470,000	526,387	441,342	487,460
Belgium	210,000	145,804	140,742	135,755
Holland	60,000	46,040	39,280	36,098
Other Countries	80,000	87,000	79,980	69,127
Total	3,630,000	2,785,844	2,481,950	2,750,206

Mr. Licht's estimates are again higher by 30,000 tons in all. The alterations are—France, 25,000 tons more; Belgium, 10,000 tons more; Russia, 5,000 tons less.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The demand for cane sugars has been steady during the last half of the month, with good enquiry for low East India kinds. Prices on the whole have been well maintained. Refined sorts somewhat recovered the decline of last month, but again close rather weaker.

Beet sugars have more extensively shared in the general advance. Increased animation in the middle of the month was largely due to the effects which are expected to follow the anticipated changes in the United States tariff, but the close has brought a slight decline, possibly owing to the further advance in Mr. Licht's estimates (see preceding page) and prices close only slightly higher than last month. Up to the end of March the quantity of beet imported during the campaign, was over 60,000 tons in excess of the corresponding period last season.

The changes in the stocks at the four principal ports, are :—London slightly behind last year; Liverpool, 14,000 tons less; Clyde, 4,000 tons more; Bristol, 700 tons less net difference, a decrease of 10,640 tons as compared with the corresponding period last year. The imports for the sixteen weeks of 1890 as compared with 1889, show a decrease of 53,075 tons.

Present quotations for the standard qualities, as under, are :—

FLOATING.			Last Month.
Porto Rico, fair to good Refining	12/9 to 13/9	against	13/- to 14/-.
Cuba Centrifugals, 97°/₀ polarization	14/3 to 14/6	,,	14/6
Cuba, fair to good Refining	13/- to 13/6	,,	13/- to 13/6.
Java, No. 14 to 15 D.S...	14/9 to 15/-	,,	15/- to 15/3.
British West India, fair brown	12/-	,,	12/-
Bahia, low to middling brown	10/3 to 11/-	,,	10/3 to 10/9.
,, Nos. 8 to 9	11/9 to 12/3	,,	11/3 to 11/9.
Pernams, regular to superior Americans..	11/- to 12/9	,,	10/6 to 12/3.

LANDED.			Last Month.
Madras Cane Jaggery..	9/6 to 10/-	against	9/6.
Manila Cebu and Ilo Ilo	9/6 to 9/9	,,	9/-

Paris Loaves, f.o.b...	16/9	against	17/-
Russian Crystals, No. 3, c.i.f.	Nominal.		
Titlers	18/3	,,	19/-
Tate's Cubes..	20/-	,,	21/-
Beetroot, German and Austrian, 88%, f.o.b.	12/3¾	,,	11/9

THE SUGAR CANE.

No. 251. JUNE 2, 1890. Vol. XXII.

☞ The writers alone are responsible for their statements.

Cheques and P.O. Orders to be made payable to The Proprietor, 6, Ward's Buildings, Deansgate, Manchester. All other communications to be addressed to The Editor, at the same address.

For Table of Contents, see page i.

On pages 286 to 290 will be found a report of the Annual Meeting of the Colonial Company, Limited, lately held in London, which will be read with interest. The very root of the matter as regards the successful production of cane sugar was reached by the chairman, Mr. Robert Gillespie, in his address on assuming the presidency, vacant through the death of the Right Hon. E. P. Bouverie. Mr. Gillespie attributed the satisfactory position of the company to the reduced cost of consumption, arising from "*the larger quantity of juice we are getting from the canes, the larger quantity of sugar we are getting from the juice*, and the finer quality of sugar we are making," and, later on, he said, "I am bold enough to reiterate that this increase in production and decrease in cost by the expenditure on improvements are the main causes of the present, as they will be of the future success of the company, and I may add that we still hope further to reduce the cost of production." We commend these words to the earnest consideration of all those who are interested in making the growing and manufacture of cane sugar a commercial success; reduction in cost of production and improved extraction of juice and sugar are the keynotes which cannot too often be sounding in our ears.

And in this connection we have great pleasure in reproducing on page 308, a portion of an article from the Jamaica *Gleaner*, which puts in a clear light, though not nearly so strongly as might have been done, the principal disadvantage under which the cane sugar industry has to labour, as compared with its great rival in Europe. The fact is surely becoming patent to the Colonial planter, the spoiled child of fortune in the past, that he is rapidly being ousted by

energetic rivals, because they are armed with the best weapons of the day, against which, favoured though he may be by nature and occasional local circumstances of comparatively cheap labour, &c., he can no more contend with his present appliances, than could our Saxon forefathers and their bows and bills with the armies of our own day?

We anticipate the best results from the forthcoming Exhibition in Jamaica, but would remind English manufacturers that their American competitors are likely to show up in force.

We extract the following from a Barbados paper of last month. It is pleasant to hear that in the island in which, above all our colonies, sugar is the staple production, such confidence is felt in the future prospects of the cane. But as regards the closing remarks we fear that but little hope can be given of any immediate permanent advance in prices on this side. It is only due to abnormal and transitory causes that the prices now current have been so well maintained, and though it is just possible that speculative operations may again (later on) cause a temporary advance, even to tolerably high quotations, such an advance cannot be of long duration, in face of the large preponderance of supply over demand which now exists.

"We are glad to say that our accounts from the country unite in praise of the month just gone. If the earlier days of March were calm and showery, the latter days were breezy and dry, and the estates in the coast parishes did great work in the way of sugar making. The yield in the boiling-house is said to be unprecedented—three hogsheads, three and a half, and in many places, four hogsheads, to the acre, have been obtained. Manure and tillage have done great things for landowners, and when they can secure the suitable canes, and get all the juice from them, there is no saying how much sugar may yet be reaped from an acre of land. Already the prospect seems to have dawned upon one of our Agriculturists, and looking to the good time that seems to be approaching, he says, "we shall make first-class crystals on the spot, and we shall be independent and care nothing about Beetroot sugar-growing countries." The writer is on the correct line, and we hope he, and those whom he represents, will realise in the near future their best anticipations. The young cane crop has made satisfactory progress, though in some places the hot suns of last week have given the tender plants a

drooping aspect. April has been decidedly dry, and the days have been hot and dusty. Advantage has been taken of the weather to push forward the reaping, planters feeling that April showers will come sooner or later. Complaints are made in some parishes that labour is not equal to the demand, and especially for cutting canes. The young labourer, it is said, shirks the field work, and gravitates to the yard and buildings. The evil seems to be increasing, and a remedy will soon have to be applied. Surely it cannot be beyond reach. In times not very long past cane cutting was the great ambition of effective labourers. What has produced the revulsion of feeling? It is worth tracing the cause, and perhaps in touching it the remedy will be manifest. In St. John's, the Water Companies are laying pipes in every direction, and paying good rates, and of course the labourer elects for that work. But laying pipes will not be a protracted service, and then cane cutters we hope will be numerous. We hear that the lessee of *Lowthers* plantation, in Christ Church parish, has erected an engine on the estate, which is working well, and will increase the quantity of sugar. There are now, it is added, 12 plantations in the parish, with 4,192 acres of land, that have steam machinery and 3 plantations, with 1,518 acres, which have steam and wind machinery; while there are 43 plantations, containing 5,972 acres, which have only wind machinery for reaping their crops. With regard to the ownership of the plantations in this parish, it may be noted that 34, containing 4,967 acres, are owned by resident Proprietors, and 21, containing 6,715 acres, are owned by absentee Proprietors. Of the plantations owned by residents, 3 only have steam machinery, while of those owned by absentees, 12 have steam machinery.

From St. Philip we are told that the new works at *Foursquare* were started in the middle of March, and were working satisfactorily. The distilling of Rum is to be undertaken on that property this season, and, it is said, will make the vacuum pan estates look to their laurels. The Water Supply Company had laid on services at the *Vineyard*, and supplied water to that place from Porey Spring in St. Thomas.

So far, we have given acceptable information to friends abroad, but we are sorry to have to add that sugar is selling in the local market at the low figure of two dollars and two dollars twenty cents per hundred, and even at that rate sales are few and far between. It is hoped, as the year advances, prices will improve, for sugar at two

dollars per hundred gives little margin of profit for the expenditure, and toil, and anxieties connected with the working of an estate."

We note that the Government of Mauritius—in consequence of a resolution adopted by the Chamber of Agriculture, requesting the Government to send a competent person to those countries where sugar cane is grown, with a view to the introduction of new varieties into Mauritius—has written to the Governments of Queensland, British New Guinea, and British North Borneo, and also to the Consul at Manila (Philippine Islands), for a supply of different varieties. No doubt the necessary precautions will be taken to guard against the introduction of any new disease, as the planters of the island have of late suffered considerably from certain pests, and, as far as we are aware, up to the present no remedy for the *sereh* has been found in Java.

Apropos of Java, we learn that Messrs. Duncan, Stewart & Co., of Glasgow, have received an order for a complete diffusion plant for that country.

According to a Spanish journal, the production of sugar from beets in the province of Grenada is assuming certain proportions. There are about 4,000 hectares (10,000 acres) under cultivation which with an average crop will yield 1,725,000 quintals of beets, to be worked up by 10 or 11 factories, which will be in operation next campaign. The estimated yield is 8 per cent., which will give about 138,000 quintals of sugar, worth about 12,000,000 pesetas, or over £460,000.

As regards the proposed alteration of the German Sugar Duties, the two sides of the question will be found in letters from the *Deutsche Zuckerindustrie* and the *Berliner Tageblatt*, on page 293.

The New Orleans Picayune gives an account, which will be found on page , of the new factory which is to be erected at Grand Island, Nebraska, for making sugar from beets by the Diffusion Process, and announces in large letters that "the West with the beet and the Southwest with the cane will supply the nation if the tariff is retained." The President, Mr. Henry T. Oxnard, stated, before the Ways and Means Society of Congress, "In 1887 we produced from the sugar beet about 200 tons of sugar, in 1888 about 1,800 tons, in 1889 about 3000 tons. In 1890, 12,000 tons will be produced."

According to the latest proposal of the Committee of Ways and Means, a premium of 2 cents per lb. is to be paid on all sugars produced in the United States. With such a bounty surely beet-growing as well as cane-growing ought to pay. It seems probable that an improved outlet will be opened for German if not also for French beet sugars.

In connection with the subject of the raising of cane from seed, which is now attracting great attention, it is perhaps worthy of mention that Mr. Alfred Fryer, the originator (in 1869) of "*The Sugar Cane*," and the inventor of Fryer's Concretor, having heard in Antigua a tradition that the cane had formerly been grown from seed, brought seed to England (about 1872) and handed it to the authorities at Kew, who successfully endeavoured to raise plants from it.

We are reluctantly compelled again to postpone an abstract of the very interesting report of the results obtained at Dodd's Reformatory, Barbados.

THE SUGAR INDUSTRY IN RUSSIA.

The official report of the results of the sugar campaign of 1887-88 has only just appeared, though too late to be of any special use, a few details may be interesting.

During the campaign in question, there were 218 manufactories at work, of these, 208 were worked on the diffusion system. The yield of sugar was 9·12 per cent. of the weight of the beets, which was very slightly below that of 1886-87. The best yield is obtained in the manufactories situated in Poland, where it was, in 1887-88, 2·16 per cent. higher than in Central Russia. There are about 40 factories in Poland. The total export, in 1888, was 5,241,756 roods = 84,230 tons, of which about three-fourths was exported on the European frontier (principally from Odessa), and one-fourth on the Asiatic (Baku).

The greater part of refined sugar exported goes to Persia, *via* Odessa, Poti, and Baku.

The wages of the workmen are exceedingly low, not averaging more than tenpence a day.

THE COLONIAL COMPANY, LIMITED.

The Twenty-fifth Ordinary General Meeting of this Company was held at the offices, 16, Leadenhall Street, London, on the 17th April; Mr. Robert Gillespie (the Chairman) presiding.

The Secretary (Mr. B. Brown) read the notice convening the meeting, and the report was taken as read.

The Chairman, after expressing regret at the absence of Mr. Nevile Lubbock, through family bereavement, said: In asking you to receive and adopt the report and accounts now submitted, I cannot allow the occasion to pass without a brief reference to the great loss the Company and the Board of Directors have sustained by the death of your late chairman, the Right Hon. E. P. Bouverie, who had filled that position since the establishment of the company in 1866. Mr. Bouverie was unremitting in his attention and solicitude for the interests of the company, and during the recent anxieties and difficulties connected with the successful management of West Indian property, he was, by his wise counsel, good judgment, and great moral courage, of inestimable value and help to his colleagues. To me individually his death is a great loss, for he not only was my colleague but my firm friend, and it ever will be one of the happiest memories of the past to me to feel I had been associated with one so able, so honourable, and so kind. You, gentlemen, I am sure, one and all, will sympathise, not only with his son, but with all those connected with him. This subject leads me to say a few words on the position which I have the honour to fill to-day. Through the kind wishes of my colleagues I have accepted the chairmanship of the company; I must say somewhat reluctantly, on the ground that I feel I have not the ability or the capacity to fulfil the duties with such advantage to the company as has followed the administration of my friend Mr. Bouverie. But, gentlemen, I will do my best to fulfil those duties with benefit to the shareholders, and I hope with satisfaction to myself. The responsibility is grave, and I shall hope, not only for the support and confidence of my colleagues, but for yours also. And now, gentlemen, I would refer to the report and accounts. On the first sheet of the report we have given you a synopsis of the profit and loss account for the year ending the 31st of December, 1889, by which you will observe that the gross profits of the year amount to £98,215 5s. 2d., leaving, after the deduction of business expenses

and interest on debentures, a net profit for the year of £71,945 12s. 4d., inclusive of a small balance brought forward from the previous year of £91 18s. 6d. These figures, gentlemen, I wish you to accept as indicating the earning power of this company, and I think they should be satisfactory to you. I may remark here that to a certain extent Mr. Bouverie anticipated this result in his speech at the meeting of the company in May last year, and they should also be satisfactory to you, especially when you consider the difficulties, the low prices ruling, and the immense crop of beetroot the company has had to contend with during the period under review. I believe when the company was established in 1866 the total crop of beetroot sugar was estimated at 600,000 tons. The present crop is estimated at 3,600,000 tons—the largest, I believe, that has ever yet been realised. Now, gentlemen, the success of this year, while partially attributable to somewhat better prices during only a part of the year 1889, is owing much more to the reduced cost of production—by the larger quantity of juice we are getting from the canes, the larger quantity of sugar we are getting from the juice, and the finer quality of sugar we are making. These advantages and benefits are undoubtedly owing to the improved machinery and other improvements we have made and carried out on our estates; and though these have cost the company a very large sum, I believe, had we not effected these improvements, costly as they have been, we should not now be in the position of showing anything approximating the result we have. Now, gentlemen, in reference to that point, I hold in my hand two statements of a very interesting character. The first I will read to you is a contrast between the results from the estates supplying the usine in Trinidad with sugar, and the results from the estates under the old system. Now, those estates supplying the usine with canes during the last thirteen years made a net profit of £132,585, or, in other words, an average of about £10,000 a year, while those estates using their own canes, and making them on the old system, showed a loss of £39,628 during the same period. The profit derived from the usine since 1877, when it was established, shows a result of £284,133 to the good, or an average of £21,856 a year. I think, gentlemen, these figures establish this fact, that we cannot afford to stand still. We must move forward and avail ourselves of such opportunities as may from time to time present themselves for the better and more economical production of our sugar. This, I hope, will be the policy of the directors—moving steadily and carefully forward, but at the

same time not losing sight of the necessity and importance of strengthening the resources of the company. Now, to refer again to the accounts. You will observe that the business expenses have been somewhat reduced, and compare favourably with the depressed years from 1884 to 1888, being upwards of £3,500 less than they were in 1884. But, on the other hand, if you compare the expenses now with those at the time the company was established, you will see they are just one-half. The expenses in the first and subsequent years were over £20,000. Our expenses this year, I think, are £10,300. I think that, again, is a satisfactory feature of our management. From this sum of net profit, £71,945 12s. 4d., the directors have deducted the instalments of improvements due from the years 1888 and 1889, amounting to £27,418 1s. 4d. The directors are also able to pay off the arrears of dividend accrued on the preference shares, amounting to £25,302 1s. 4d., and to place £10,000 to the reserve fund, carrying forward a balance of £9,225 9s. 8d. to next account, all of which I am quite sure you will approve of. I take this opportunity, gentlemen, to refer to the preference shares. You are aware that they carry 6 per cent. interest. The question of converting a further number of ordinary shares into preference shares has been pressed on the notice of the board by several influential shareholders whose opinions we are bound to consider, and I feel that it is very desirable, and it would strengthen the hands of the directors, if some expression of opinion was offered by you to-day. The matter has been under the consideration of the directors, and it would assist them greatly were they able to gather to-day the opinion of the gentlemen on the other side of the table on this subject. I have already referred to Mr. Nevile Lubbock, who has just returned from the West Indies, after a careful inspection of the company's estates. I was going to refer to him for a report which I am sure would not only have been exceedingly interesting but instructive and satisfactory. Suffice it, however, for me to say that I believe there are no estates in the West Indies in finer order, and very few in such good order, as those of the Colonial Company. Another thing, we have the right men in the right place. It is not simply the opinion of Mr. Nevile Lubbock, but I hear it on all sides, from those who are interested in the West Indies and have estates out there, that there are none managed better than those of the Colonial Company. I think this must be not only satisfactory to us on this side of the table, but to you also, gentlemen. I hope I shall not weary you with my figures, but some of those which I have been

attempting to master during the last few days present such interesting features that I am loth to pass them by without referring to them; and my object is to compare the last year's success with that of the year 1877, when the company was able to present to the shareholders the largest amount of profit made in any one year. The gross profit of that year amounted to £142,540, as against £98,215 in 1889. Now, gentlemen, I avail myself of the gross profits, because I think they show to you the earning power better than the net profits. In the year 1877 the company spent £8,892 on improvements, while in 1889 the amount spent was £28,636. The aggregate of sugar made in 1877 was 15,689 tons, at a cost of £20 6s. 9d. per ton of vaccum pan, and £19 4s. 1d. per ton of Muscovado sugar, while in 1889 we made 22,739 tons at a cost of £13 13s. 1d. per ton of vaccum pan, and £11 10s. 4d. per ton Muscovado, showing a reduction in cost of production of £6 13s. 8d. in vacuum pan sugar, and £7 13s. 9d. per ton in Muscovado sugar. You will, at the same time, have noted that the crop had increased from 15,689 tons in 1877 to 22,739 tons in 1889. That is the prettiest colouring, I must admit, of the picture. The sugars realized in 1877—the prices being then very much higher; in fact, they were something remarkable—£26 10s. 1d. per ton vacuum pan and £20 19s. 7d. per ton Muscovado, while in 1889 they only realised £15 17s. 7d. and £13 3s. 3d. per ton respectively. Now, gentlemen, I am bold enough to reiterate that this increase in production and decrease in cost by the expenditure in improvements are the main causes of the present, as I believe they will be of the future success of the company, and I may add that we still hope further to reduce the cost of production. I hope we may yet get it down £1 or 30s. more. There is a subject which has usually been mentioned at our late meetings, and that is the bounty question. I fear it is in abeyance, and there seems at the moment little chance of the subject being brought before the House of Commons this session; but we must hope that it may yet be carried out, and that a system so unjust to home and colonial interests and industries may be got rid of. I daresay most of you have seen the news from the House of Representatives in Washington, that the tariff committee have recommended the abolition of duty upon sugar of a certain class. If that is carried out it will be a very important matter to all the West Indian interests, and there seems to be reason to suppose that it will be carried out; at least, let us hope so. Now, I think I should be remiss in my duty were I to allow this opportunity to pass without paying a tribute to

our managing directors, and especially to Mr. Nevile Lubbock, who has been on a visit of inspection to the West Indies, and whose report, I hope, in some shape or other, will yet be before you. I would, therefore, express my wish that a vote of thanks should be passed to the managing directors and to the staff generally. They are zealous, they are able, and they are loyal to us, and I am quite sure that their attention is given to the interests of the company. I will now, gentlemen, simply conclude by intimating that I shall be very glad to give any further information in my power should it be asked for, and in the meantime I shall ask you to receive and adopt the report and accounts.

Mr. Walter P. Bouverie seconded the resolution, which was put and carried unanimously.

Mr. Walter P. Bouverie then proposed the re-election of the retiring directors, Mr. Robert Gillespie and Mr. Nevile Lubbock. He took the opportunity of thanking Mr. Gillespie for the very kind words he had used with regard to his father, and expressed his conviction that the interests of the shareholders would in no way suffer under the chairmanship of Mr. Gillespie. Mr. Nevile Lubbock was a most useful gentleman on the board. The knowledge and ability which he brought to the service of the company were quite invaluable to it, and he was sure the shareholders would unanimously agree to the re-election of these two gentlemen.

Mr. Woodhouse seconded the resolution which was cordially adopted.

On the motion of Mr. Scrutton, seconded by Mr. Langridge, the auditors, Messrs. Price, Waterhouse and Co., were re-appointed.

Mr. Scrutton proposed a vote of thanks to the chairman and his colleagues.

Mr. Scott seconded the proposition, which was passed unanimously.

The Chairman acknowledged the compliment, and stated that he had omitted to refer to one important point, which would be satisfactory to the shareholders. In looking over certain papers, he was very much struck with the large amount of gross profits that the company had made since its establishment. They had made over 1½ millions of gross profits and divided over half a million amongst the shareholders, while the usine alone had made £284,000 profit since they started. He thought these figures were very encouraging. They had a concern that had a great earning power, and it only wanted fair prices and economical working to make it a great success. He expressed the hope that during his reign of office he might see a large and satisfactory improvement year by year.

GERMANY.

THE PROPOSED ALTERATION OF THE SUGAR DUTIES.

THE FRENCH, BELGIUM, AND GERMAN BOUNTIES.

From the *Deutsche Zuckerindustrie.*

Almost at the very time that the Prussian Minister of Finance made the announcement in the Budget Commission that a reform of the Sugar Duties—naturally in the financial interests of the State—was engaging the attention of the Government, there appeared in the public press a statement of the Imperial Revenue for the official year 1889-90, which showed an exceedingly favourable result; on the total receipts an increase of M.78,239,381; from the duties and taxes on consumption in particular, an increase of M.56,702,951, and especially on the sugar duties an increased revenue of M.786,590. In any case, therefore, the sugar duty has produced an amount exceeding the expectations of the Government. In view of this development, would it not be better to wait and see the further results of the legislation of 1887, instead of afresh exciting the apprehensions of the industry by the announcement of projects of reform. According to the explanation of the Finance Minister the proposed reform would put an end to the premium on exports, the only weapon of the German industry in the contest on the open market. Whether this has become the weapon of its opponents will be best seen by casting a glance over the figures of the international sugar market.

At the time that Germany gave up half of the duty on the raw material, France, as is well known, abandoned the duty on the manufacture, and adopted that on the raw material. All at once the French production attained unexpected dimensions, for, whilst in the campaign of 1884-5 the yield of sugar, calculated in refined, was only 5·81 per cent., in 1888-89 it reached 9·83 per cent., and in 1889-90 attained 10·375 per cent. The French production, calculated in raw sugar was in 1884-85, 310,000 tons, whilst the latest estimates for the campaign just closed run up to 780,000 tons. In 1884-5 Germany produced 1,155,000 tons and in 1889-90, as far as yet known, 1,180,000 tons. Thus we have for Germany an increase of 150 per cent., in Germany almost a standing still.

For this enormous advance the French sugar industry is indebted

to the change in the system of taxation. For the year 1888-89 a yield of 75 per cent. (in refined sugar) on the beet was assumed on which duty was to be paid at the rate of 60 francs per 100 kilos. But with the actual yield of 10·375 per cent., mentioned above 2·875 per cent. was obtained above the legal yield. On this excess-yield 20 francs per 100 kilos. were levied by the Government, so that the duty free profit was 40 francs per 100 kilos. As according to the above yield we must reckon 28·75 kilos. of duty-free sugar for every 75 kilos. on which duty is paid, the profit on these 103·75 kilos. is then 11·5 francs, equal to 11·08 francs or 8·87 marks per 100 kilos. (4s. 5d. per cwt.) *which is the premium which is obtained by the French manufacturer.*

We assume that the extent to which this favouring of the French industry manifests itself in a remarkable increase of the export is perfectly well known. The export of French sugar to England in 1889 is quite double that of 1888. And we meet with the same phenomenon in the excessive export of French sugar to other countries. Thus the export of French refined sugar to Chile, Uruguay, and the Argentine Republic, has also doubled since the new law came into force in Germany. For the next few years France can reckon confidently on an increased export of from 300,000 to 400,000 tons as against 1888-89.

Even though the French premium should be reduced, this will not materially alter the fact, that a competition has sprung up on the part of France which threatens the existence of the German sugar industry, which would become still more dangerous if Germany should take the step of abolishing the remainder of the premium by giving up the tax on the raw material. Belgium is also in a position to sell at much lower prices in consequence of her mode of levying the duties. The Belgium production, which in 1887-88 was 121,643 tons, in 1888-89, 124,000 tons, is calculated at 210,000 tons for 1889-90. The Belgium law of 2nd April, 1889, fixes the normal yield at 1,650 grammes of sugar for every degree of density from 1 hectolitre of juice; 1 degree of density=1·01 specific gravity is equal to 2·695° Brix. As good beets give for 1° Brix a yield of 750 grammes of sugar polarising 94% to 95% for every hectolitre of juice, the gain in the Belgium factories, which pay 46·52 francs duty on 100 kilos. of sugar, types 14 to 17, amounts to 8·35 marks per 100 kilos. (4s. 2d. per cwt.) of sugar, or *not much less than the French premium.*

Now as regards the premium obtained in Germany, we may take as basis for 1889-90, a production of 1,260,000 tons and a yield of

12·75 per cent., according to which 7·843 kilos. of beets are required for the production of 1 kilo. of sugar of 90% (minimum) up to 98% polarisation. The duty to be paid is then $7·843 \times 0·80 = 6·275$ marks, and as the drawback on export amounts to 8·50 marks, the premium is 2·225 marks on 100 kilos. (1s. 1¼d. per cwt.) of sugar. Then we must take into account the decrease of the consumption in Germany. In 1888, the consumption per head was 9½ kilos., in 1889, 8½ kilos. The circumstances as just stated are scarcely such as would justify any further restriction of the already scanty protection which the German sugar industry enjoys. On the contrary, we should hope that the Government will above all things so far understand the interests of the industry, which the Finance Minister, in the sitting already referred to, promised to protect as much as possible, as not to place any further obstacle in the way of its foreign trade, so that it may not fall a victim to its competitors. If the scanty reports published are correct, the Finance Minister also referred in the same sitting to the agricultural interest to which he declared due regard should be paid. It is, therefore, in place to mention the view which the official Sugar-Enquiry-Commission of 1889 took of the interest of the agriculturists in the tax on raw material. It is stated in the report of the Commission, to which was added the motives justifying the last law, that under the prevailing system the value of the land, in proportion as it is capable of producing good beets, had risen in an extraordinary degree. The abandonment of this system would undoubtedly result in a marked depreciation of value over a considerable area and would be productive of severe agricultural crisis in the districts affected. These remarks are still perfectly applicable to the situation.

From the *Berliner Tageblatt.*

A report has lately been going the round of the press that the committee of the Union of German Beet Sugar Manufacturers was about to address to the Government a petition for the retention of the tax on the raw material. It might well be expected that the sugar manufacturers would move heaven and earth to retain for themselves the tax on the raw material and the export bounty which depends upon it. On the other hand it becomes the first duty of the State, in consideration of the prospective increase in the salaries of officials and in the military expenditure, to abolish all such unnecessary preferential gifts.

Let us just look at the monetary sacrifices which the country has made for the campaign of 1889-90 in favour of the sugar industry. According to the Act of July 9th, 1887, the tax on the beets is 40 pf., and the premium on export 4·25 mk. per centner (cwt.) With this proportion of the beet-tax to the premium on export, the legislation was based on the view that 10⅝ centner of beets were required for the production of one centner of sugar, for 10⅝ by 40 pf.=4·25 mk. In the campaign of 1880-90 the beet crop was 196,000,000 centner, from which, according to the above statement, the total production should be, in round figures, 18,500,000 centner of sugar. Now as the inland consumption amounts to 9,000,000 centner, there would remain for export 9,500,000 centner, on which the bounty would have to be paid. The income for the State from the tax on beets would then have been as follows:—

	Mk.
196,000,000 centner of beets at 40 pf.	78,400,000
Deduct bounty on 9,500,000 centner of sugar at 4·25 mk.	40,400,000
Net revenue	38,000,000

But, in the campaign 1889-90, not 18,500,000 centner, but 25,000,000 centner of sugar were obtained from the 196,000,000 centner of beets. Hence only 7⅘ centner, not 10⅝ centner of beets were required to produce one centner of sugar, and after deducting the quantity required for the home consumption, *i.e.*, 9,000,000 centner, there are 16,000,000 centner of sugar for export on which the bounty has to be paid. The revenue from the beet-tax then is as follows:—

	Mk.
196,000,000 centner beets at 40 pf.	78,400,000
Deduct bounty on 16,000,000 centr. of sugar at 4·25 mk.	68,000,000
Net revenue	10,400,000

The State thus suffers a clear loss of about 28,000,000 mk., and reckoning cost of administration, the beet tax of 1889-90 will produce nothing. Why then should a tax be retained which brings in nothing and at the same time causes great inconvenience to the manufacturers? If the tax on the beets is got rid of, inland sugar will be about 3·25 mk. per centner cheaper, and there could be no doubt whatever that the home consumption would increase.

SUGAR PRODUCTION IN INDIA.

About a year ago a letter was addressed by Messrs. J. Travers and Sons, Limited, to the Secretary of State for India, calling attention to the present defective state of the Indian sugar industry, and suggesting the establishment of model factories. This letter was sent to the Indian Government. Certain officials who were invited to consider the various questions expressed their opinions unfavourably, as, for instance, the director of the Agricultural Department for the North-Western Provinces, and the director of the same department in Bengal, both of whom thought that the scheme would not pay. In December the Indian Government reported to the Secretary of State for India, and their reply was communicated to Messrs. Travers and Sons, who replied briefly.

We give extracts as follows from the original communications of Messrs. Travers and the reply of the Indian Government, merely remarking that it has long been regarded as a very unsatisfactory state of things that a country such as India, possibly the ancient home of the cane and the first producer of cane sugar, should import its best qualities from Mauritius and from Europe.

Extracts from the letter of Messrs. Travers and Sons :—

"The average production of India is given as a ton of sugar per acre, and the produce (with the exception of the three modern mills in Madras) is of the most wretched character. In the West Indies (which are also backward) sugar growers obtain two tons of sugar per acre, or double the Indian average, and, with modern machinery, properly crystallised sugar can be made direct from the cane juice at a cost on the spot (that is, without carriage) of 8s. to 10s. per cwt. It is no doubt the competition of such direct cane sugar from Mauritius which is leading to the closing of refineries in Bengal, if, as we imagine, those refineries work, not from the sugar cane, but from coarse native sugar.

"In all the statistics sent us, Mauritius and similar sugars are described as refined, but this is altogether misleading. There are no refineries in Mauritius, where sugar is remelted, and the produce of the island is simply raw sugar properly made by modern processes. It is such sugar that India ought to make, and the Empire, with sufficiently improved cultivation and machinery, might readily supply the world with sugar. Refining is a secondary process, likely to altogether die out, by slow degrees, as cane and beet manufacture

becomes more perfect. The disappearance of refining in Bengal, though hard upon individuals, is really a sign that there is progress elsewhere, and progress which no country is better adapted than Bengal to share in.

"That modern sugar can be well made in India is shown by Messrs. Minchin, at Aska, Madras, and it is simply absurd that India should have first to export the labour to Mauritius, and then to re-import sugar from that distant island, which could be as well made, and certainly more cheaply, at home. India is generally regarded as the home of the sugar cane, and with its teeming population, its climate, and (in some districts) its plentiful water and coal supply, it should be a large exporter of fine sugar instead of an importer.

"The manufacture of modern (or, as it is called, vacuum pan) sugar, to be profitable, must be on a large scale, because it involves costly machinery and chemical and mechanical supervision impossible for ryots, who probably do not extract one-third of the sugar that might be extracted from their crops, and make that third in a shape that looks more like manure than sugar, and which appears to fetch in many parts of India as little as 6s. per cwt. on the spot, whereas Mauritius sugar in India must net double that to pay the grower. Vacuum pan sugar making is, probably, only possible on a large scale in India through the central factory system, where the raw canes are bought by the mill from the growers. A system similar to this already prevails in indigo and silk mills in Bengal.

"We do not know whether the Government of India would be able to start a few model factories in suitable districts, or whether they must confine their attempts to develop sugar manufacture to the collection of information and figures like those in the returns forwarded to us. In any case, the efforts of the Government in this direction for some years past cannot fail to be of great value."

Reply of the Indian Government.

"The improvement of sugar production and manufacture in this country has been the subjects of attention both of the authorities and of capitalists since the beginning of the century, and various attempts have been made to establish factories, none of which appear to have been attended with any permanent success unless supplemented by the sale of rum and liquors. Sugar refining alone has not proved sufficiently profitable to maintain a factory. If this had been the case there appears to be no reason why the industry should not have been largely taken up by private capitalists."

"Some of the main difficulties against which the industry has to contend are believed to be these :—

"(*a*) The cultivation of sugar cane is limited by the supply not only of water for irrigation, but also of manure.

"(*b*) As cultivation in India is confined to small farms or holding, each cultivator who is able to grow the crop at all can only find manure enough for a small area, generally less than half an acre, of sugar cane. The plots of sugar cane are therefore greatly scattered even in a canal-irrigated tract.

"(*c*) A central factory has accordingly to bring in its supplies of cane in small quantities over varying distances, in many cases the distance being great.

"(*d*) The carriage of canes over a long distance, even in a climate like that of the Mauritius, is detrimental to the juice for purposes of sugar making. It is much more so in India, where the canes ripen at the season when the atmosphere is driest and suffer, therefore, the maximum of injury.

"(*e*) The Mauritius system of growing large canes at intervals is not adapted to the greater part of India where, in order to prevent the ingress of dry air into the field, small canes have to be grown in close contact.

"(*f*) The amount of cane which can be grown, limited as it is by the supply of water and manure, barely suffices for the wants of the Indian population. It seems to be at present as profitable to produce coarse sugar for their use, as highly refined sugar for export. There is, therefore, no sufficient inducement to capital to embark on the more difficult and expensive system.

"A further obstacle to sugar refining in India exists in the high differential rate which the conditions of our excise system require to be placed upon spirits made on the European method, as compared with that levied on spirits manufactured by the indigenous process. The sugar refiner in India is thus placed at a disadvantage in respect to the utilisation of his molasses in the form of spirits.

"In view of the circumstances above noted, we are unable to advocate any attempt being made at the cost of the State to establish model factories. We are inclined to attach much confidence to the views and conclusions formed by Messrs. Thomson and Mylne, who have paid, for many years, practical attention to the subject of sugar cultivation and manufacture by ryots, and were the first to introduce

the portable sugar mills which have now spread over India. They advocate the gradual improvement of the ryots' method of manufacture rather than the introduction of more expensive and centralising systems. The Provincial Departments of Agriculture have, of recent years, directed attention to this question, and may usefully be desired to continue to do so.

"We are also willing to advocate the establishment of agricultural experiments in those comparatively limited tracts of the country (such as Eastern Bengal, where there is a moist climate and a more or less abundant supply of manure) in which the Mauritius methods of cultivation have *primâ facie* prospects of success, and we are prepared to advise our Local Governments and Administrations to give every reasonable support to sugar factories and refineries which may be established by private enterprise."

Messrs. Travers & Sons contented themselves with acknowledging the attention paid to their remarks, but added the following significant postscript to their letter :—

"We may mention that 'German granulated,' a small white dry crystal sugar made direct from beetroot, is now being shipped from Hamburg to India ; so that the ryots will not have Mauritius only to compete with at home. We believe this sugar costs about 16s. per cwt. laid down in Bombay, and that the bounty on its export does not exceed 6d. to 9d. per cwt."

We think the bounty on the sugar in question is understated.

In connection with the above, the following letter of Mr. Kollman, Manager of the Aska Works (near Madras), to the *Allahabad Pioneer*, will be read with interest :—

"I have read your recent article on the production of Indian sugars with great interest. What a waste of raw materials when Indian sugar cane of quite a superior quality is converted into such an inferior and low-yielding product as the native *goor*, of which you give a description. But how can it be otherwise? How can we feel surprised at such deplorable final results, if we are compelled to witness up to the present day the rude, barbarous treatment to which the cane sugar is subjected by the native sugar-boilers. Doubtless, by more careful work, by greater exercise of skill and attention, a better product might be obtained, but the native process of crushing the cane even with improved mills will always remain a very unsatisfactory one with regard to extraction. The establishing of central factories, especially each working with the diffusion process, will put

a final stop to this perpetual national economical sin of destroying sugar, will increase the resources of the country, and, last but not least, will be the salvation of the cane ryot. The diffusion process to which I allude above was introduced into the Aska Sugar Works as far back as 1867 by Mr. F. J. V. Minchin, the present proprietor of the works, who by perseverance and close study has brought this process to its present state of perfection and development, so that already in some of the factories in Demerara, Java and Australia, the most powerful and expensive cane mills have been laid aside for this process. As it might interest you to hear a little more of this method I enclose herewith a memorandum, drawn up for the Glasgow Exhibition of 1888, and I may add that with the diffusion process direct from the cane white or yellow sugar of superior quality can be obtained within 24 hours without the aid of animal charcoal and without the expensive and complicated machinery for refining. I am sending you two samples of sugar, the first quality a white sugar, the second quality a yellow clarified sugar, and I may add that 25 per cent. more of this sugar is obtained by this diffusion process than by the most powerful mills of Demerara of Louisiana."

SUGAR INDUSTRY IN THE CANARY ISLANDS.

In our issue of last December we referred to the progress of sugar manufacturing in the Canary Islands, and are now able to furnish more accurate details respecting what is being done there.

There are seven islands in all, viz. :—Grand Canary, Teneriffe, La Palma, Fuenteventura, Lanzarote, Gomera, and Hierro. Sugar cane is grown extensively in the three first of these.

Grand Canary produces more cane than any other of the islands, in the following districts :—

Arucas.—Here there are two factories erected by Messrs. Duncan, Stewart and Co., of Glasgow, viz..—

One large complete factory with mill 30in. by 60in., triple vacuum pans, centrifugals, &c., complete, and able to turn out twelve tons with ease in as many hours—one ton per hour.

The other factory is a small mill, 18in. by 30in. on face, with open evaporating and vacuum pan and two centrifugals.

Guia.—There is a Company formed called "The Grand Canary Sugar Co.," with a capital of £10,000, for the purpose of erecting a

mill in this city, which will begin crushing in February, 1891. The shares of this Company were, we understand, all placed in Manchester. The machinery is being constructed by Messrs. Fawcett, Preston and Co., Limited, of Liverpool, and is in all respects like that described below for Teneriffe, except that an improved De Mornay cane mill is substituted for a Rousselot mill.

TELDE.—There is a mill in course of erection in this city, belonging to Mr. John Rodriguez Gonzalez, which will begin operations next season.

TENERIFFE.—The only mill of any importance in this Island will be that being constructed by Messrs. Fawcett, Preston and Co., of Liverpool, for Messrs. Lathbury and Co., which is being established in the North of the Island, on an estate called Daute; this mill will be capable of treating 100 tons of cane per 24 hours.

The machinery left England at the beginning of the present year.

The crushing portion of the plant consists of a three-roller Rousselot's patent cane mill, fitted with Jeremiah Howard's hydraulic attachments, the steel cylinders of which are provided with double leathers, arranged according to Watson's patent, so that only one is at work at a time, and the other is in reserve. Should a leather burst while crushing is going on the reserve leather can be put into work at once without stopping the mill, and the burst leather may be removed and renewed at any convenient time when the mill has ceased work. All interruptions in grinding are thus avoided.

For the treatment of the juice the apparatus is provided with defecators, juice clarifiers, Chapman's patent triple effect evaporating apparatus, syrup clarifiers, bag filters, vacuum pan, suspended centrifugals, continuous steam still, and multitublar boilers, arranged to work with the megass straight from the mill.

The chief novelty in the evaporation portion of the plant is the self-balancing and self-adjusting triple effect apparatus, which since its introduction, in 1888, has met with so signal an approval from planters in all parts of the world, that the makers, Messrs. Fawcett, Preston and Co., Limited, of Liverpool, have received orders not only for a large number of new plants, but for the converting of many existing plants, not only of their own make, but also made in the principal establishments in Scotland and France.

PALMA.—There is every probability that a Company will be shortly formed to work this island.

We are informed that the *fanegada*, which contains 5,500 square metres, will yield in these islands 50 tons of cane if properly cultivated.

This is equivalent to about 36 tons per acre.

SORGHUM SUGAR IN INDIA.

Letter to the *Indian Agriculturist.*

You will receive by this post, an unopened sample of "Sorghum Sugar," made by the Kowur Jai Narain Sing of Didwarry, from the juice of the "Alapore jowar."

The celebrated sugar candy of Ajmere is made from this variety of sugar, and in the Hurriana district this sorghum is cultivated for sugar production. In Ajmere the *sugar cane* cannot be grown, as artificial irrigation is not available, and the same is the case in the Hurriana district. Whereas the "Alapore jowar" can be sown, grown, and harvested in all parts of India without any other trouble than that of preparing the land and sowing the seed, and as this sorghum has been grown by me, from seed sent me, at an elevation of 7,000 feet above the sea level, its introduction into Europe and Australia should prove a success and the same may be predicted in reference to experimental culture in the United States of America. The sweetness of sugar made from sugar cane depends on the soil in which the cane was grown; in the West Indies a loam rich in lime and other plant-food yields the sweetest sugar, and in India calcareous soils will do the same. The "black cotton soil of the Deccan" contains 16 per cent. of "carbonate of lime" and 10·2 per cent. of "magnesia" and is therefore admirably suited for sugar sorghum culture, and the yield should be of the best quality. I have drawn attention to this subject of sweetness as the sample of sugar sent may not be quite as sweet as your sugar-cane sugar made by Bengal zemindars. It is no unusual occurrence to meet with cane sugar deficient in sweetness, and the deficiency of lime in the soil explains the matter.

In America various kinds of sorghum have been cultivated, but up to date no dry sugar has been obtained from their saccharine syrups.

In India, from a remote period, "goor" sugar and sugar candy has been made from the "Alapore jowar," and as the Chinese make their

sugar and famed sugar candy from the juice of the sugar sorghum, it is reasonable to draw the conclusion that China obtained its *sugar sorghum* from India when *Buddhism* was introduced, and as the ruins of ancient Buddhist monastries are met with in the Delhi district, this is by no means improbable. The Alapore jowar yields a second or *ratoon crop* like sugar cane, and I think under suitable dry cultivation, it will prove to be an easily grown and very profitable crop. If no objection exists, the sample of sorghum sugar sent might be shown in your office to all comers, and especially to the Consuls of Italy, Germany, and France, and I shall be glad to cause seed to be sent them for transmission to Europe for experimental cultivation. I venture to hope that your Bengal titled and untitled wealthy landed proprietors will also give the Alapore jowar a trial, and if any of these gentlemen will address the Kowur Jai Narain Sing of Didwarry, *viâ* Mooradnugger, zilla Meerut, he will supply seed and information as to culture. In conclusion I shall be happy to answer any letters addressed to me on the subject under notice.

J. F. P.

Daisyburn, Kotghur.

BUNDABERG (QUEENSLAND) SUGAR INDUSTRY.

By the Special Reporter of *The Queenslander.*

Bundaberg is essentially a centre of the sugar industry. This industry has grown and extended until to-day the valley of the Burnett, the rich volcanic areas of the Woongarra Scrub, and even large tracts of the forest lands have been converted into fields of waving cane. The primitive methods of the old régime have disappeared before the age of scientific cultivation, and the sugar industry —unlike its forerunners—is "run" for every shilling it is worth. It was sugar alone that improved the values of the local lands, and induced speculators to place expensive buildings on the town lots; and capitalists from far and near to provide the sugar-planters with machinery, valued at £771,199, for the manufacture of their product. Let us glance for a moment at the industry which has so revolutionsed the agriculture of the immediate sub-tropics.

The sugar exported from Bundaberg during the past three years has been:—In 1887, exported and removed coastwise, 13,096 tons. In 1888, exported, 7792; removed coastwise, 7998; total, 15,790

tons. In 1889, exported, 3770; removed coastwise, 5927; total, 9697 tons. To this may be added, say, 500 tons per annum for local consumption; and a simple calculation at an estimated value (all round) of £15 per ton will give the export value of the product. The foregoing statistics show three graduations of season—one fairly good, one only middling, and one decidedly bad. The forthcoming season, however, is expected to outstrip them all, the estimated yield being upwards of 20,000 tons.

During my recent visit to Bundaberg several matters in connection with the sugar industry made a somewhat marked impression on my mind. One was that the industry is not extending. Has it, then, reached the meridian of its existence? It is not apparently declining like the industry at Maryborough, and yet it is not progressing or extending in due proportion to its magnitude—it is evidently standing still. It is impossible that any great enterprise shall remain stationary for very long. In the case of the sugar industry why should not the natural tendency be in the direction of progress?

The sugar-planter will tell you how the cultivation of sugar is of such a character that white men are unable to do it; and that still they deny to the planter the privilege of engaging black men who can. The Polynesian labourer is referred to as "reliable" in contradistinction presumedly to the white man who is "unreliable." Can this be so in actual fact? With a view to elucidating, in some slight measure, the labour problem likely to arise after the close of this year, when by the Act of 1885 all further introduction of Polynesian labour will be stopped, I discussed the matter freely with all the sugar-growers and manufacturers I met during my recent tour in the Wide Bay and Burnett districts. I found, indeed, that the labour question was the topic of the time.

THE LABOUR PROBLEM.

Mr. Angus Gibson, managing partner of the firm of Gibson & Howes, of Bingera plantation, situated twelve miles from Bundaberg, on the north side of the Burnett River, is one of the representative planters of Bundaberg, and is also one who in a notable degree has given white labour a chance to live on his estate. This is what he says:—"In the season I employ seventy white men; and have 200 blacks on the plantation all the year round." Fifteen years ago Mr. Gibson cultivated 200 acres of sugar at Hemmant, solely with white labour, and made the enterprise successful in a marked degree. In reply to my reference to that bygone experience, Mr. Gibson

stated:—"When white labour was plentiful at £30 per annum and rations, with sugar in demand at from £32 to £35 per ton, the industry paid fairly well. The hours of labour were twelve daily." "Would not the central mill principle admit of the industry being carried on with white labour solely?" I inquired. "The central mill system, on a small scale, was in vogue at Hemmant," replied Mr. Gibson, "but I found that the cane-growing farmers were very unreliable. In those days 14s. and 15s. per ton was paid for cane delivered at the mill." "And what are you going to do for labour at the end of 1893, when the kanakas are withdrawn?" was the next question; "will the sugar industry die so far as you are concerned for want of suitable labour?" Mr. Gibson (earnestly): "I will push on without black labour until I sink; I will never give up." The resolute and manly reply is characteristic of the man; and it is more than probable that even the gigantic labour difficulty will vanish in the face of such courage. At Bingera there are 1,200 acres under crop; and a sugar output of 2,500 tons is anticipated for the forthcoming season. Two classes of refined sugar are made, the net average value of which is £17 per ton. The capital invested in the estate is £100,000 and interest, at the rate of 9 or 10 per cent. per annum, has been realised from the outset. Mr. Gibson's closing remark was, "that the Bundaberg district was far more favourably situated than any other for the exclusive employment of white labour."

I also elicited a few opinions on the labour topic from Mr. Samuel Johnston, of Waterview, one of the pioneers of several branches of industry at Bundaberg, and finally a sugar planter. Mr. Johnston thinks that without black labour the sugar industry will experience a lingering death. To use his own words, "the planters will get out of it as best they can." Mr. Johnston further expressed the opinion that, even after the expiry of their agreements in 1893, the kanakas would remain in the district of their own free will and work for wages in the canefields, Mr. H. A. C. Young, of Fairymead, is a capital business man as well as a planter, and has a very large stake in the sugar industry. He takes a gloomy view of the situation. Fairymead, like Bingera, is a gigantic concern, its cultivated area being 1,250 acres. Raw sugar only is manufactured here, yet so excellent is its quality that it competes most successfully against the best refined. The Youngs have reduced the manufacture of sugar to a system such as none of their district contemporaries have yet

attained. Mr. Young thinks that without some measure of compensation the sugar industry will be in a very bad way after the withdrawal of the kanakas. "Yes, the system of cane farming and central milling would be feasible if the colony had a tariff advantage over the sugars produced by black-labour in other portions of the globe; but not otherwise." Mr. Young can see no prospect in the future that is not fraught with disaster for the sugar industry. At present Fairymead employs 75 white men in the season, and 300 blacks all the year round. The white men receive double the money paid to the blacks, notwithstanding the great difference in their respective numbers; that is not including clothes, rations, and passage money provided for the latter. Mr. Hickson, of Rubyanna, who employs 25 whites in the season, and 70 blacks all the year round, also takes a very despondent view of the situation, and thinks the sugar lands will have to be converted to another purpose after the kanakas are withdrawn.

The Central Mill System.

Is it unconsciously or is it in preparation for the "great struggle" expected to succeed the close of 1893, that two of the largest planters are already adopting the central mill system in the district of Bundaberg? The great refinery, Millaquin, with its capital investment of from £150,000 to £160,000, has all along been a central mill of a certain kind, and has been directly, for the greater part, independent of black labour. The rich plantations of the fertile Woongarra are mostly provided with mills which merely crush the cane but do not manufacture the sugar. The extracted juice, after being "limed," is conveyed to Millaquin, through an intricate system of underground pipes, for manufacture. The giant mill, like the smaller manufacturing concerns in the district, only works during the "season," that is to say, when the cane is mature, and the density of the juice has reached its maximum height. The crushing generally begins with the winter and lasts right through until the beginning of the ensuing summer. In the intervening months the refinery is a scene of restless energy, the machinery working day and night. Here 170 white men and 18 blacks are employed. Mr. John Cran, the manager, states that the "boys" are only employed at such work as white men have repeatedly refused to do, mainly, I imagine, among the molasses and in the sugar drying. The output from Millaquin during a good season is 10,000 tons, representing a market value all round of £21 per ton. Here, it will be seen, half the entire output of the district

is manufactured, and, comparatively speaking, with white labour. The great refinery, as a refinery, is not directly interested in the black labour question at all. Black labour is employed in cultivating the cane which produces the juice that Millaquin manufactures. All the Millaquin constituency is within the 10,000 or 12,000 acres of rich volcanic land known as the Woongarra Scrub. Less than a decade has passed since the smiling canefields here to-day were a mass of the thickest and most luxuriant scrub. The land, too, in places bore a thick covering of stones, which were probably shot out from the hummock—in the volcanic ages—together with the rich deposit of lava which, now decomposed, forms the chief constituent of the soil. The scrub has been hewn down and burnt, the stones have been removed and put into the roads or converted into fences, and the land is now in the highest possible state of cultivation. Will not mechanical cultivation in such a case in a great measure replace the system of land cultivation?

I have thus looked at the refinery as the huge progenitor in this district of the central mill. The other two are Fairymead and Bingera, whose centralising operations are of comparatively recent date.

The Gooburrum Scrub is quite adjacent to the mill at Fairymead. Its primary agricultural efforts were confined to maize-growing, which was chiefly in the hands of a very few settlers until less than two years ago, when the proprietors of Fairymead made overtures to the farmers to grow cane. The farmers here have now 500 acres of cane under cultivation, and intend planting 300 more in the forthcoming autumn. The Messrs. Young have connected the scrub with their mill by tramway, and they provide the labour to cut the cane and load the tramcars, and pay the fatmers 7s. per ton for the cane. This arrangement, however, is to last only as long as the kanaka labour. After that the farmers will have to seek their own labour from other sources, and a new arrangement altogether will require to be made. As it is now, the farmers provide and plant the land, and keep the young cane free from weeds until it grows high enough to choke them. This system appears to present all the elements of great success. At Bingera, similarly, Mr. Gibson has entered into an agreement with twenty farmers to supply him with 500 acres of cane, 400 of which is now growing. The farms are situated in a scrub three miles from the mill, with which they, also, are connected by tramway. The farmers are paid 9s. per ton, without deductions, for

the cane. Mr. Gibson admits that he regards this as a partial solution of the labour problem. It is not possible that finally this system—at least in the Bundaberg district—may prove a remedy for the entire difficulty? If it does, agriculture generally will here receive an impetus it has never known before. There are at present 2,350 kanakas in the Bundaberg district, of whom 2,100 are under agreement with the sugar planters. The proportion of white labour and black employed in the sugar industry is in the ratio of four whites to ten blacks.

The Immediate Prospect.

The immediate prospect before the sugar industry is, as has been hinted before, splendid. The planters are counting on the certainty of four more crops before the termination of the kanaka system; and the first of the series will certainly be one unparalleled in local experience. I have visited the sugar estates on the Herbert and Burdekin rivers in the far North, as well as those of Cooktown and Mackay, but have never seen cane superior to that which is growing in the neighbourhood of Bundaberg just now. It may roughly be estimated at a two-ton crop all round. A distillery recently established at Bundaberg buys molasses from its sugar-growing shareholders at 3d. a gallon. As the molasses was hitherto entirely wasted all this means additional profit. In the same connection, Mr. Faucher, of the firm of Faucher & Clark, of Brisbane, is offering a patent to the Bundaberg planters for the conversion of molasses into sugar, one gallon of molasses yielding 4lb. sugar. If this proves successful the exclusive employment of white labour may easily become compatible with profitable production, no matter how the case stands now. Mr. Faucher propounds—and I think for the first time—that somewhat extraordinary theory that glucose as a constituent of sugar-cane has no existence in fact. This, if true, is one of the latest discoveries of scientific chemistry, the presence of glucose always having been regarded as one of the chief obstacles to successful sugar manufacture. Mr. Faucher was experimenting at Rubyanna at the time of my visit.

In conclusion, I may remark that the town of Bundaberg shows an extreme degree of commercial depression considering the magnificent prospects of the forthcoming sugar season. I was told that this was the result of the present policy of the financial institutions interested in the properties and industries of the town and district.

JAMAICA.

New Implements and Machinery required.

Among the necessities of the time are new implements of husbandry for our people. It is fifty years since the demon of slavery was struck down and the people, enfranchised from the condition of mere chattels toiling for the good of others, were elevated to the condition of free men, entitled to enjoy the fruit of their labour, and therefore interested in forcing the best results out of the time and energy employed in such labour. With this freedom they have also enjoyed the means of acquiring education—education by which they should be taught, at least the value of time and the duty of turning time to the best account. Strange to say, the implements by which they till the soil are no way changed from those they used fifty years ago. The cutlass and the hoe are all they know about, and to tell them of a plough that might be used in their small fields would be to talk in a mystery and say things that would be to them like a dream. With the cutlass and the hoe they continue to plod, and the result is they are content with a small return and can hardly be convinced that there are instruments in use in other countries for the cultivation of the soil that save human labour and human energy, and yet give better results than the utmost that human labour and human energy, employing old-fashioned implements, could ever produce. These are some of the things that our people have to learn, and which it should be to the interest of all who have the welfare of the country at heart to see that they do learn.

At best, labour-saving machines are little known, or at least little employed in this country. Even among the better class, to what extent can the present be said to be an improvement upon the past? In respect to the machinery for the production of our principal staple, it is only within a few years that any courageous attempt was made to keep abreast of other countries employed in sugar manufacture; and in saying this we may still ask, upon how many estates are the latest improvements to be found?

It is by this means that beetroot has been, to a great extent, enabled to work out the triumph it has achieved over cane. From the day that the rude stuff as an apology for sugar was obtained from the beet, up to the present, when an article unsurpassable in whiteness is

produced, science has never been at rest in the European sugar-producing countries to bring the material to perfection; and cane sugar will never hold its own completely against beet sugar, even when bounties are abolished and immigration becomes a universal faith, until the best appliances that science and inventive genius can produce, are made available.

QUEENSLAND.

THE SUGAR QUESTION: A BOUNTY ASKED FOR.

A meeting was held in March, at Mackay, of a Committee composed of twelve gentlemen—three representatives each of the Labourers' Union, the farmers, the planters, and the Chambers of Commerce—to discuss the best means for preserving the sugar industry, and to report to a public meeting. The following report was unanimously adopted:—

"That this Committee, recognising the prosperity of Queensland, demands that no effort should be spared to preserve the sugar industry, which is the means of affording employment to many thousands of people, and makes the following recommendations for the consideration of a public meeting on Wednesday, 19th inst.

"That this Committee, recognising the difficulties which would arise from an attempt to bring about reciprocity with the Southern colonies, owing to the opposition which may naturally be anticipated from those engaged in certain industries in South Queensland, recommends:—1. That since the right to employ coloured labour hitherto enjoyed by those carrying on the sugar industry has been withdrawn, the Government be invited to pass a measure giving a bounty of £5 per ton on all sugar exported. 2. That in order to give assistance to farmers and small planters the Government be asked to make provision for the supply of tramways and irrigation. 3. That in order to enable the sugar industry to be carried on with white labour alone, the Government be invited to take measures enabling the Government to purchase the sugar plantations and mills, with the view to cutting up the estates into small farms and placing thereon a population of farmers capable of carrying on the industry, repayment of the purchase money to be made on the same principle as applies to loans to public bodies."

THE COST OF SUGAR PRODUCTION IN CUBA.

From the *Revista de Agricultura.*

The question of the amount of cane produced by a given quantity of land is naturally a difficult one, depending, as it does, upon a number of circumstances, such as the kind of soil, the variety of the cane, the mode of cultivation, the time of sowing, the system of cultivation, &c.

Our *collaborateur*, Don Juan Bautista Jimenez, calculates that whilst a caballeria of land under exhaustive cultivation produces some 60,000 arrobas (of 25 lbs.) of cane per 17 or 18 months, new soil, well prepared, sown with carefully selected seeds, intelligently and considerately cultivated, would be capable, in a favourable year, of producing 148,000 arrobas.

The average production for five years for the whole of the island is generally supposed to be as follows:—One caballeria of land cultivated exhaustively for a long succession of years will give 40,000 arrobas, and one situated in a district newly brought under cultivation will yield 60,000 arrobas; so that the first would give in five years about 200,000, and the second about 300,000 arrobas.

COST OF PRODUCTION OF THE CANE.

Rent, preparation, and sowing of one caballeria of land	$724
Seed...	120
Clearing, hoeing, etc., during the first year	476
For the four succeeding years at $342 per year	1,368
Total for five years	$2,688

Thus the cost per 100 arrobas (about 22 cwt.) in case the production per caballeria were 200,000 arrobas in five years would be $\frac{2,688}{2,000}$=$1·344, and in case the production were 300,000 arrobas, $0·893.

Assuming then that the cutting, loading, and carting per 100 arrobas (about 22 cwt.) would be $0·80, we shall find that the 100 arrobas of cane, delivered at the mill, will have cost:—

Caballeria of 40,000 arrobas.		*Caballeria of 60,000 arrobas.*	
Cultivation	$1·344	Cultivation	$0·893
Cutting and carting	0·800	Cutting and carting	0·800
	$2 144		$1·693

i.e., the 200,000 arrobas, $4,288; and the 300,000, $5,079.

COST OF MANUFACTURE.

Assuming that the extraction of the sugar contained in 100 arrobas of cane, or rather, that the working of 100 arrobas of cane is worth $1, the arrobas of sugar will cost :—

With an extraction of 6½ per cent.............	$0·154
,, ,, ,, 7½ ,, ...	0·133
,, ,, ,, 8½ ,, ...	0·117

If then the caballeria produces 200,000 arrobas of cane in five years, the production of sugar and its cost per caballeria will be :—

At 6½ per cent., 13,000 arrobas	$2,002
,, 7½ ,, ,, 15,000 ,, ...	1,995
,, 8½ ,, ,, 17,000 ,, ...	1,989

And if the caballeria produces 300,000 arrobas, the production of sugar and its cost will be :—

At 6½ per cent., 19,500 arrobas............	$3,003·00
,, 7½ ,, ,, 22,500 ,, ...	2,992·50
,, 8½ ,, ,, 25,500 ,, ...	2,983·50

Taking as basis for the price of the arroba the mean figure calculated by our associate on the 8th of June, for 90° polarisation for all packings and ports indifferently during four years, the result is $0·7175, so that we shall get the following amounts as the value of the respective yields in the two cases under consideration :—

13,000 arrobas, at $6·7175 =	9,327·50
15,000 ,, ,, ,, =	10,762·50
17,000 ,, ,, ,, =	12,197·50
19,500 ,, ,, ,, =	13,991·25
22,500 ,, ,, ,, =	16,143·75
25,500 ,, ,, ,, =	18,396·25

The above data contain the necessary elements for arriving at the profit to be obtained from a caballeria of land, whether it produces 40 or 60,000 arrobas, and whether the yield is 6½, 7½, or 8½ per cent.

THE BEET SUGAR INDUSTRY IN THE UNITED STATES.

The British steamship Nymphæa is now unloading at New Orleans a cargo of machinery for the beet sugar factory which will begin operations on September 1st, at Grand Island, Neb. The complex, delicate, and massive apparatus, forming almost the sole cargo of the vessel of 3,000 tons burden, is only part of the sugar-making machinery to be used in the factory. The boilers and steam power works have been secured in America, yet another cargo will shortly arrive on the steamship Ocean.

The Nymphæa hails from Antwerp, Belgium, and brought over fifty tons of seeds of sugar beets, and the elaborate machinery intended for the factory, which represents the latest improved sugar-making diffusion apparatus in France, Germany, Austria, Bohemia, and other beet-growing countries, in which the science of sugar-making has been advanced.

At present there are only two beet sugar factories in the United States. Both are in California. The Western Beet Sugar Company is situated at Watsonville, Cal., and handles 300 tons of beets per day. The other is smaller; it is the Alameda Beet Sugar Company, at Alvarado, Cal., and handles 150 tons of beets a day.

The third factory will be at Grand Island, Halls county, Neb., 150 miles from Omaha, and the centre of a rich agricultural area. It is projected by the Oxnard Beet Sugar Company, which has a capital of $1,000,000, and will be able to handle 350 tons of beets per day, making it larger than any other beet sugar factory in the United States, and much larger than the average factory in Europe.

The president of the company and its leading and active manager is Mr. Henry T. Oxnard, now quite prominent in congressional work relative to the sugar question and tariff revision. The company has gone into the matter after investigation and study covering a period of two or three years, and every variety of test has been made to assure them that the conditions were favourable to a successful and prosperous outcome.

Last year beet seeds were planted in some fifty or seventy-five different localities by the above Company in the Western and Pacific States, with a view of learning the beet growing qualities of the soils of the United States. The result was astonishing. It was found that the percentage of sucrose in the American grown beet was some

4 per cent. over and above the sugar-giving qualities of the German and French beet.

After these tests, Mr. Oxnard, who is a wealthy and scientific gentleman who has devoted much time to studying the problems of sugar production, concluded to erect a test factory, which it is hoped will lead to the building of others in the west, the combination of western and southern influence in maintaining the tariff on sugar, and the ultimate home production of all the sugar consumed in the United States.

Grand Island, Neb., is in the midst of a corn-growing country, and it has been ascertained in Europe that wherever corn (or maize as it is there called) has been successfully grown, the beet will be particularly healthy and the crop most lucrative.

The annual yield of an acre of beets can be estimated at a minimum of fifteen tons, and the net profit to be derived from one acre is from $25 to $40, against a profit of $6 50c. to $8 50c. on an acre of corn. Although the labour connected with the cultivation of the beet is greater than that of corn, the profit on the crop is sufficient in proportion to make it very inviting to the farmers to go into beet culture.

It is possible that the western people will find in the beet industry a rescue from the present aggravated situation of mortgaged farms, foreclosures, sales, and debts.

Without a home market and good prices, corn and wheat growing in the west results in loss, not gain. The real reason of this is the fact that the railroad charges consume too great a portion of the farmer's vitality, as to find a market they must ship across the country to the seaboard for exportation. In the proposed beet industry the markets will be at the very doors of the farmers. The beets will be delivered in the raw state to the factory either by waggon or railroad, at small cost.

The sugar produced will equal 13 per cent. to 14 per cent. of the gross weight of the beets. This will be shipped by rail by the sugar factory. The farmer will at no time be at the mercy of the commission merchant, but will receive his money on a specific contract at home with reliable people, and his farm will return him in round figures $25 to $40 net for every acre he has planted in beets.

Mr. C. Kennedy Hamilton, jun., one of the members of the Company, has been unloading the ship for more than a week, and estimates that it will take at least ten days to complete the work of

unloading. He has already forwarded several trains of machinery to Grand Island, and is sending them off daily. It will require at least 100 cars to transport the machinery which arrived on the Nymphæa, while almost as much more will come on the steamship Ocean.

The factory buildings at Grand Island will cover about seven acres of land. Most of them have already been constructed, the greater part being of solid stone and brick. They only await the putting up of the sugar-making machinery, and will be ready for operations on September 1st. It will require 3,000 acres of land planted in beets to run the factory. The crop will mature about the time the factory is ready for it—*i.e.*, in September and October.

In addition to the machinery, the Nymphæa brought over fifty tons of beet sugar seed.

Two tons have been sent to the department of agriculture at Washington for general distribution, and the rest will be used for planting purposes in Nebraska. This season the Government has had a great number of applications for the seed. There have been some 2,000 to 2,500 requests coming from all points of the country, and more applications are received daily.

The Company, as will be seen, have large interests, and to support them are striving to secure the support of the west and northwest for the continuation of a protective tariff on sugar. The matter is now presented to Congress in this light: Sugar-making is a national industry, not a sectional one, and has immense monied and economic interests at stake. If the sugar duty is removed all these will be broken up.

DIFFUSION *versus* CRUSHING.

See *Sugar Cane* for April, 1890.

We regret that we have hitherto not been able to find room for some extracts from the valuable paper read by Dr. W. C. Stubbs, before the Sugar Planters' Association at New Orleans on the 13th March last. We now proceed to do this, remarking that our information is obtained, as usual, from the *Louisiana Planter*, in the management of which Dr. Stubbs takes a leading part.

"I have remarked that diffusion could extract all the sugar from the cane. This is true, yet experiments have proven that the limits of profitable extraction at present are, perhaps, reached when less

than 5 per cent. of sucrose is left in the chips. A further extraction involves an unprofitable dilution.

This limit, with a proper working of a battery, can be reached by drawing off a weight of juice equal to the chips diffused. If the cane contain 10 per cent. of fibre and 12 per cent. of sucrose, an approximate average of this state, this extraction will represent nearly 96 per cent. of the sugar of the cane, or an extraction of juice equal to 86 per cent. of the cane diffused. If the dilution be extended so that only 1 per cent. of sucrose be left in the chips, then the extraction will be over 99 per cent. of the sugar in the cane.

The best five roller mills working without saturation rarely obtain a greater extraction than 70 per cent. on the cane worked—with saturation about 75 per cent. The relative extractions, then, of a five roller mill without saturation, and of diffusion are 70 per cent. and 86 per cent. Of five roller mills with saturation 75 per cent. and 86 per cent. Therefore diffusion will extract 16 per cent. on the weight of cane over the unaided mill and 11 per cent. on the mills with saturation. In the former case there will be 16 per cent. dilution. In the latter dilution will be about equal or perhaps greater with the mills. It is then perfectly fair to say that diffusion as now practiced will yield at least 16 per cent. on the cane worked over the best mills unaided, and 11 per cent. over those using saturation. These are actually gains of 23 per cent. and 15 per cent. on the sugar made.

I can not speak positively of the extra cost of fuel in diffusion. A larger volume of juice is always obtained. The fuel value of both chips and saturated bagasse is inferior to that from a five roller mill unaided. Time and careful experimentation is needed to decide the extra fuel required for this increased evaporation and for running the mill to squeeze the chips. This extra cost must be credited by the 23 per cent. increase of sugar. To summarize, we may say that a crop of cane that will produce one million of pounds of sugar by the mill unaided, will produce 1,071,428 lbs. by mill and saturation, and 1,228,555 lbs. by diffusion. This compares common diffusion with the best mill results. Should dilution be carried so as to secure a chip containing only ·1 per cent. of sugar, the above crop would yield 1,271,428 lbs. Diffusion will therefore give us the greater yield, and our energies should be strained to simplify and perfect the machinery employed. This will ultimately be done, for when humanity rests upon a problem, sooner or later it will be solved.

There are, however, many conditions essential to successful and economical diffusion which are yet to be learned.

So far, experience has taught us that fineness of chip, high temperature, and time, are necessary for good work. The finer the chip, the better the extraction *always*. In fact, this is the *first* requisite of good diffusion, and with it both of the other conditions may be lowered without serious consequences. A high temperature is favourable to extraction; therefore the cells should be provided with calorizators of such power as to give a uniform temperature of at least 200 deg. Fahr. throughout the battery. Time is needed for the hot water to extract the sugar, and the amount required depends largely upon the successful attainment of the other conditions. With very fine chips and a high temperature, six minutes to a cell may prove abundant time for full extraction. Ten minutes to a cell has, however, been adopted in all the best regulated houses. A continuous current through the battery is far better than an intermittent one, and the deeper the cell within bounds, the better the diffusion process operates. This can easily be demonstrated by the application of differential calculos to each individual chip or cell in the chip, and holds good until the depth of the diffusion cell becomes so great as to subordinate this principle to a well known law of hydraulics. The strength required of the bottom and sides of a cell limits the depth, and forces the manufacturer, when capacity is required, to give width.

The advantage of a continuous current through the battery, and the better diffusion in a deep cell, have suggested the possible success of 'continuous diffusion' in one cell, a problem which several ingenius mechanical engineers are now striving to solve.

One improvement in the construction of our present batteries is imperatively needed. Each individual cell must be heated at pleasure. This can easily be accomplished by connecting each heater with its cell, both from below and above, and thus permitting the establishment at will of a continuous current through the cell and its heater, until the requisite heat is obtained, without disturbing the action of the other cells of the battery. Those who have carefully watched the battery when at work have frequently noticed the inequality of temperature of the different cells. In a line battery the centre cells are always hotter than the exterior ones, and some device is needed to adjust this injurious inequality."

THE PROGRESS OF SUGAR CULTURE AND MANUFACTURE IN LOUISIANA.

A Paper Read by Judge Emile Rost, of Jefferson, at the Fourth Annual Session of the Louisiana Agricultural Society.

The subject which I have been requested to discuss before you presents so many questions that, in order to be brief, I will simply give you a general view of what has been done in the sugar business, especially during the past twenty-five years. The cultivation of sugar cane has existed in Louisiana for more than a century. Martin, in his history, states that the manufacture of sugar was commenced in 1764, and that it was abandoned two years later, and was again resumed with success in 1794. Only horse power mills were used until 1825; the introduction of steam mills gave the first great impetus to the business, for in less than twenty years after the crop of the State had reached 450,000 hogsheads, or nearly 250,000 tons, being at that time nearly one-half of the consumption of the entire country. In 1888 sugar was manufactured in twenty-three of the parishes of the State; there were in operation 776 sugar houses, of which ninety-one only were worked by horse power; of the total number, 147 were provided with vaccum pans. We find that these sugar houses produced more than half the entire crop, the production of the larger houses having increased every year, while that of the smaller houses, on the contrary, diminished. When after the close of the war the sugar planters, encouraged by the high price of sugar, undertook to rebuild their industry, the business from 460,000 hogsheads in 1861, had fallen, in 1865, to 15,000 hogsheads. Most of the sugar lands had been abandoned, the levees had been neglected, overflows were almost periodical, and a new system of labour had to be organised and adapted to the requirements of the cane crop. It took many years to overcome these difficulties, but in 1887 the crop obtained from 130,000 acres of cane, ground throughout the State, produced 285,000 hogsheads of sugar. I venture the assertion that the number of acres in 1887 does not represent one-half of the amount of land cultivated in cane in 1861. Bouchereau, in his report for 1887, claims that planters using modern machinery obtained an average of 2,929 lbs. per acre, or 128 lbs. per ton of cane ground, while those using other appliances obtained 2,510 lbs., or 103 lbs. per ton of cane. Under the old slave system, when the

planter had a plentiful supply of labour and held it under control, the cane crop was, so to speak, a hoe crop, the cleaning and the weeding and the covering and the digging were all done with the hoe; with lands well drained and thorough cultivation, the sugar crops increased rapidly up to 1861, although up to that time the manufacture had made little progress. This was all changed in 1865, and the first problem to be solved was how to replace by labour saving machinery the old hand labour which was leaving the cane fields and was becoming every day more scant and more unreliable. To this necessity we owe the introduction of various implements of immense value; such as the the cane rollers, which press the dirt on planted cane when covered with the plough, the cane shavers, which clean from the stubble the dead wood and the winter grass, the stubble digger which, with its iron fingers, revolves along the row and turns and loosens the soil about the stubble cane so that there is nothing left to do but to pull the dirt away, and finally that most useful of all implements, the horse hoe or cane cultivator, which covers or uncovers the cane, adds dirt or takes it away according to the requirements of the crop. With these improved implements, nearly one-half of the former hand labour required is done away with, but as the price of sugar kept going down the planter found he must increase his yield per acre in order to hold his own, and this necessity brought about another great step forward, the general use of fertilisers. Twenty years ago many planters objected to the use of cotton seed meal as a fertiliser for cane, claiming that it stimulated vegetation and destroyed the sugar, and at that time commercial fertilisers were used on but few plantations; to-day a large trade exists both in cotton seed meal and other fertilisers, thousands of tons are applied every year and with such good results that the demand for fertilisers increases steadily. On some of the larger sugar places the item of fertilisers represents every year an outlay of thousands of dollars, and yet this heavy expense is found to be profitable, as it has raised the average production per acre to nearly double what it was twenty years ago. Within the last five years two new factors have appeared in support of the Louisiana sugar industry: 1. The establishment at Kenner, by voluntary subscription, of a sugar experiment station, and the selection as director of that station of Professor W. C. Stubbs. You know what has been done since then at the State Experiment Station at Baton Rouge, and at Calhoun, at the North Louisiana Station. I speak only of the sugar station now located at Audubon Park in the city of New

Orleans; the periodical bulletins issued during the past few years from Kenner have been of vast benefit to the sugar planters; the field experiments and the laboratory work have already produced such marked results in chemical study that the station during the past season could not supply the demand for sugar house chemists in this State.

The second great factor to which I alluded was the establishment by the Department of Agriculture of Washington of a diffusion plant at Magnolia plantation, and the continuance of experiments at that point on the most liberal scale until the manufacture of sugar from Louisiana cane by the diffusion process was triumphantly proved and the possible extraction of 200 lbs. of sugar from a ton of cane became an accomplished fact. It is now sixteen years since the first experiments with the diffusion process were attempted at Belle Alliance, in Assumption, and subsequently at Louisa plantation in St. Charles. After one or two seasons both experiments were abandoned, and it remained, after many years for the liberal policy of Commissioner of Agriculture Coleman to take up diffusion and make it a success. During the tests at Magnolia as high as 230 lbs. of sugar were obtained from a ton of cane. There are to-day eight or nine diffusion plants in Louisiana and Texas; most of them have worked but one season, and have made no complete return of the work done; but it is admitted on all sides that the general success has been marked, and additional plants are already spoken of for the coming season. The increase is only restricted by the heavy cost of the first outlay; many planters would adopt it at once but for the want of capital to make it an individual enterprise, for it is manifest that if the average production of sugar mills throughout the State will not exceed 110 lbs. to the ton, even if it reaches as high, diffusion with its possible extraction of 200 lbs., and even with an average extraction of 180 lbs. to the ton, would every year almost double the production.

I now come to the subject of central sugar factories. In the West India Islands, where cane is cultivated, the system of central factories prevails.* Stock companies with large capital have been formed for the purpose of sugar manufacture, and they have put up factories with complete plants and most improved machinery. Sugar cane is bought by the ton as raw material; the cane grower receives in payment either a money price or so many lbs. of sugar for each ton of cane.

* Only partially, especially as regards the British Colonies.—[Ed. *S. C.*]

The factory people have nothing to do with cultivation; they merely manufacture whatever cane is furnished to them and give their whole attention to the full extraction of the available sugar in the cane. The same system prevails in the beet sugar countries of Europe. The beet growers have no other care than to make as good beet as possible, and sell their crop by weight to the factory. In our own country, Mr. Claus Spreckels, two years ago, put up a factory at Watsonville, in California, at a cost of $400,000; the first season's output of sugar was 1,600 tons, and if my recollection is correct, Mr. Spreckels stated last year, before a congressional committee, that he had made a profit from this factory of nearly $30 per ton of sugar, which would represent 12 per cent. on the whole cost of the factory. Even in the State of Nebraska, the people of Grand Island have recently agreed to subscribe $100,000 toward the erection of a beet sugar factory sufficient to work up 5,000 acres of beets in the vicinity.

In our own State there is not to-day one central sugar factory organized on a plan similar to those I have mentioned. In the Teche country refineries have been established for the purpose of granulating syrups boiled in neighbouring sugar houses, and on a few large plantations excellent results have been obtained from the cultivation of cane on the tenant system, but these are only exceptional and local results, and leave the general system of the State unchanged. In the the parish of St. Mary a new enterprise has recently been started, looking to the formation of a company for the erection of a central factory in the upper part of the parish. This is a step in the right direction. It will require but one successful experience in Louisiana in ventures of this kind to make similar factories spring up in other parts of the State. This would prove such a stimulus to cane growing that we would very soon see the old sugar lands, now given up to rice culture, reclaimed for sugar, and the sugar business would again come to the front. The advantages of central sugar factories could not be presented more clearly than in the following, which I quote from an article in the New Orleans *Times-Democrat*:

"The idea of a central sugar factory means that the manufacturing and agricultural department will be separated. It goes without saying that the separation of these departments will benefit the planters and the country. Agriculture as improved and developed requires all the skill and attention that one man can give it, and especially is this true of the growing of the cane. Of the manufacture of sugar, itself a well developed but still developing science,

the same may be said. It is an occupation making full demands upon the time and attention of any one man. The amount of mechanical, chemical and practical knowledge required to carry on a successful sugar house is quite absorbing and exclusive enough to exhaust the energy and capacity of any individual to the exclusion of all else."

In conclusion, let me say that in spite of occasional failures and disappointments those of us engaged in sugar manufacture in southern Louisiana have full confidence in the future of sugar. We believe it possible to go on improving until the yield per acre will be raised from 3,000 to 5,000 lbs. We also believe that, under the beneficient influence of the Experiment Station at Calhoun, the farmers of North Louisiana will learn to make cane growing and even sugar manufacture profitable in their section, and when this success is obtained, we may all rejoice together, for everything that tends to diversify our crops adds wealth to the country and lands increase in value as we increase their wealth producing capacity.

THE HYATT JUICE EXTRACTOR.

(From the *Louisiana Planter.*)

Mr. J. W. Hyatt, of Newark, N.J., of Hyatt filter fame and Mr. G. L. Spencer, assistant chemist of the Department of Agriculture, have again been to Governor Warmoth's Magnolia plantation to make further experiments and improvements on Mr. Hyatt's juice extractor, which if made the success that it promises will effect a revolution in the extraction of cane juice.

Mr. Hyatt is not expecting to make his apparatus an instant success, but with long mechanical and engineering experience, and with phenomenal success in the apparatus that he has already invented, he approaches this problem with the easy air of Edison, who has taken the lightning in his hands and made it talk. And Mr. Hyatt says there is much juice in the cane not economically extractable by any known process, and that he proposes to solve the problem.

We have described the apparatus before, but as our readers may not be familiar with the ideas involved, we shall describe it again.

The accessories of engines, shafting, carriers, &c., are not material parts of the invention and may be modified in any manner that circumstances may suggest.

In the extraction of cane juice by mill pressure the .extremest pressure is reached at the line of nearest contact of the rolls, and the juice is expected to retreat from this line, but experience shows that much of it goes on through in the interstices between the particles of cane, and in much of it pressure can not yet overcome what is retained by the capillary attraction, and never can until the pressure is so great as to evolve heat, and this seems not to be economically practicable.

In the extraction of cane juice by diffusion it is done by a series of subtractions, during which nearly all the contained sugar solution is gotten out and is replaced with water, but there is always a greater or less remainder, and there is a resulting dilution that is objectionable.

Now Mr. Hyatt comes with a machine with which he promises us all the advantages of the cane mill, but with practically a complete extraction of the cane juice, instead of *five-sixths* of it, as now gotten by our best mills.

To accomplish this, he has first invented a cutting machine to prepare the cane for the final work. This is done by a series of circular saws three-fourths of an inch apart, on a cylinder some twenty-four inches in diameter, and resembling a large cotton gin. The odd feature about this machine is that the saws are secured upon the cylinder in lines oblique to the axis of the cylinders. This obliquity is three-fourths of an inch from a line perpendicular to the axis, and hence in every complete revolution of the cylinders its saw edges will have travelled one and a half inches forward and one and a half inches back, or a lateral travel of three inches for each saw every revolution, apart from the rotary movement, which is about 1,000 revolutions per minute.

The feeding and discharging devices are simple and easily managed. The work of this machine is one of the wonders of modern sugar mechanics. We all know that sugar cane is made up of fibres the full length of the canes, growing tougher toward the rind and tender toward the centre, and all filled in between with cellular matter, which, after pressure, resembles wheat bran. This machine of Mr. Hyatt reduces the cane at once to the condition of *fibrous sawdust.*

The cane thus prepared is carried on a belt to the juice extractor, Mr. Hyatt's *pièce de resistance* and on which he hinges his success in this direction. This is a truncated cone of cast-iron, the smaller end 3½ feet diameter, the larger 4 feet, and this casting resting on a proper bed plate, at an angle of about 40 degrees above a horizontal line;

to the smaller end there is bolted a *vertical* neck or cylinder 15 inches in diameter; in this there is placed a plunger of the same diameter, which has 15 inch stroke. This cylinder has a side opening or port of about 8 inches height and the full width of the cylinder's diameter—say 15 inches. This side opening has attached to it a hopper into which the cane dust falls, and in the bottom of which there is a flat plunger properly geared, which, at each stroke, drives the contents of the hopper into the extraction cylinder. All the incidental mechanism is but a matter of detail, and seems now to be handsomely worked out by Mr. Hyatt, although he claims it is but experimental. The great truncated cone has a head at the lower and larger end, fitted with strong toggle joint rods, and an especial hydraulic packing, making an effective joint under any pressure yet applied.

The mechanical displacement theory that Mr. Hyatt claims as the basis of his invention may be better understood by now following the work of the machine.

The cone is filled with water almost in an instant from a 6-inch supply pipe, and filled up to the vertical cylinder. The apparatus then started, the incoming cane dust falls upon the top of the contained water, forced thereto by the plunger. The plunger has a perforated head, and if the cylinder had a solid bottom, the plunger driving the cane dust against it, the juice would accumulate on the top and rise through the perforations into the body of the cylinder, whence it emerges through a brass pipe in the centre that serves as a guide rod for the plunger. But as all the juice can not be gotten out by such pressure, or by any pressure, as our best mill practice shows, Mr. Hyatt here introduces the greatest novelty in his device. Water is practically incompressible and yet is mechanically divisable beyond the reach of the microscope. Mr. Hyatt crushes the cane dust down into the bottom end of the cylinder, where it rests upon a column of water. He continues to force it down and into the cone. The cone being full of water and that incompressible, the cane can not enter it without a corresponding amount of water coming out, and, as but very little of the cane is fibrous or cellular, say 10 per cent., that much of the weight of the cane is driven into the cone; an equal amount of water coming out of the cone is thus driven through the incoming cone, driving before it mechanically, and not by solution, the 90 per cent. of liquid already in the cane. The 10 per cent. of water is thus used as a mechanical agent to drive the juice out of the cane dust, as a divisible solid as it were, capable of reaching into

every recess, and yet practically a solid water piston; to effect this, this one-tenth of the water has to go over with the juice, causing that much dilution.

Mr. Hyatt's figures are thus far only approximate, but let us examine them anyway, and see how they will turn out.

The cone contains ninety cubic feet, and when filled with water would then contain 5,625 pounds of water. It is estimated to take in the bagasse or exhausted cane dust from four tons of cane. Four tons of cane would contain, say, 800 pounds of fibre and 7,200 pounds of cane juice. Mr. Hyatt proposes that the 800 pounds of fibre shall enter the cone, and that to admit it, 800 pounds of water shall emerge, and in emerging shall drive the 7,200 pounds of cane juice before it and with it making 8,000 pounds of diluted juice.

This matter of displacement seems to be an old method in many of the arts. In one country sugar factories, where they now have syrup pipe lines, they drive the syrup out by following behind with water, and there is practically no mixing, the water piston driving the syrup steadily before it.

Mr. Hyatt now proposes to extract, practically, all the sugar in the cane, and he seems to have an apparatus that will enable him to do it.

The apparatus now erected at Magnolia is presumed to have four tons charging capacity, and Mr. Hyatt thinks that, when he reduces all the minor difficulties, it can be charged and discharged every twenty minutes, giving the apparatus a capacity of 12 tons per hour, or some 250 tons per day.

Based upon the figures that we have given, the resulting bagasse would contain about the same proportion of moisture as the original cane. Ten per cent. of fibre going in and 10 per cent. of water coming out of the cane, would leave the bagasse, chip or cane dust $\frac{9}{10}$ water and $\frac{1}{10}$ fibre. This would be valueless for fuel, though certainly in an excellent shape to go through any mill, and yet may be in excellent condition for paper stock, the remaining fibres, two or three inches long, seeming to be in fit condition for immediate manufacture into paper.

It is much to be hoped that Mr. Hyatt will make his invention a practical success, and that right at Magnolia, where, under the surveillance of Governor Warmoth and Mr. G. L. Spencer, those experiments in diffusion have been made that have made diffusion the success that it now is in the tropical cane world.

ON THE DETERMINATION OF ASH IN RAW SUGARS.

BY F. G. WIECHMANN, PH.D.

The method formerly used for determining the ash in sugar consisted in carbonising the sample at a low heat, extracting the soluble salts from the carbonaceous mass by boiling water, igniting the residue, adding this ash to the aqueous abstract obtained, and evaporating completely to dryness.

In 1864, Scheibler published his method of incinerating sugars with sulphuric acid, which proved to possess great advantages over the former method in ease and dispatch of execution. It was only given to the world after the originator had tested it for five years, and carried out by it more than two thousand determinations.

Of course, neither Scheibler's method nor the method of incineration referred to pretend to give the actual amount of *salts* in the sugar, for by the former the salts are changed into sulphates, while combustion transforms them into carbonates or oxides. Landolt, for instance, holds that the weight of the *salts* in beet-sugars is about twice the weight of the *ash* found by an analysis.

As the molecular weight of the sulphates is greater than that of the carbonates, Scheibler substracts 10 per cent. from the weight of the sulphate ash, and states that the result is then identical with, or at least corresponds very closely to, the values obtained by the other method. In his paper previously referred to, several analyses are cited in support of this claim.

A cursory search through the literature at hand shows that the method of incinerating with sulphuric acid has been examined into by several chemists, of whom some do not share Scheibler's estimate of its value.

Boivin and Loiseau endorsed the method as capable of giving constant results if the combustion were slowly conducted, but claimed that it yielded exceedingly variable values if this condition were not fulfilled. As their experiments, however, were partly carried out under conditions entirely different from those prescribed by Scheibler, their verdict is of little importance.

Dubrunfaut studied the method chiefly as to the value of the factor 0·9 used in transforming the sulphates into carbonates, and expresses himself as follows:—" In this method sulphuric acid is

substituted for the chlorine of the chlorides and for the carbonic acid which is yielded by the organic acid salts and the nitrates. As the relations between the organic acid salts, the nitrates, and the chlorides are very variable in beets, in the molasses, and in the sugars, it stands to reason that the factor 0·9 is nothing but a general average factor which, in many cases, may be considerably far from the truth."

Violette, in an article published in 1873, states that "this method of incinerating sugars with sulphuric acid, generally adopted at the present time, gives the weight of the ash higher than the true weight of the ash in raw sugars, and this difference is the greater the richer the ash is in salts of soda and alkaline carbonates."

The following year this author wrote a paper entitled "Determination of the Relation between the Real Ash and the Sulphated Ash in the Products of the Sugar Industry," in which he published a table giving a *résumé* of his researches. This table embraces the analysis of raw sugars, beets, and molasses, and shows the difference between the amounts of the real ash and the values obtained by the sulphuric acid method. The differences exhibited are very considerable in many cases.

H. Leplay, in his "Chimie Théorique et Pratique des Industries du Sucre," page 207, commenting on these figures and on the conclusions which Violette bases on them, says:—"The most striking conclusion to be drawn from the analyses of M. Violette is that this factor is very variable and does not offer sufficient guarantee of correctness for the transformation by calculation of the weight of the sulphates found by analysis into carbonates."

On the other hand, Von Lippmann, after giving the analysis of a carbonate ash of a representative sample of beet sugar, which will be referred to later on, says:—"It seemed of interest to ascertain the relation of this carbonate ash to the sulphate ash which might be obtained from it. Ten grms. of ash were calcined with sulphuric acid in a platinum muffle, and 11·2008 grms. sulphate ash were obtained. If one-tenth be deducted from this figure, as is done in commercial practice, 10·0807 grms. results, instead of 10 grms., thus demonstrating most perfectly the correctness of Scheibler's factor, 0·9, for this case."

Although primarily applied to the determination of ash in beet-sugars and beet root products, Scheibler's method won its way into general favour, and soon came to be almost the only method

employed in practice, and to be applied indiscriminately to the ash determination of all sugars.

In the course of some research work recently carried out by the author, quantitative determinations were made of the ashes of sugars from various countries.

The scheme of analysis adopted was the following:—

Ten grms. of sugar were dissolved in hot water and filtered;* the residue was thoroughly washed with boiling water, and the filtrate and washings evaporated to dryness. The mass was carefully carbonised, and then extracted with boiling water until nitrate of silver no longer gave the reaction for chlorine. Solution 1 was evaporated to small bulk. Residue 1 was dried, ignited, and weighed. This weight was noted as insoluble ash. The solution and the ash obtained were combined, hydrochloric acid was added, and the solution evaporated to dryness. All the chlorine was then driven off, the residue taken up with water and a little hydrochloric acid, and filtered. The insoluble residue in the filter was thoroughly washed, and the washings added to the filtrate. Residue 2 is silica. To filtrate 2 added ammonia hydrate, boiled, and filtered. The residue 3, iron and alumina, was thoroughly washed, and the washings added to filtrate. To filtrate 3 added ammonium oxalate and evaporated to dryness. The ammonia was burned off, and the oxalates changed to carbonates by adding a little ammonium carbonate, and then again driving off the ammonia. The mass was then taken up with water, filtered, washed, and the washings added to the filtrate. This residue, residue 4, consists of carbonates of calcium and magnesium. The filtrate was evaporated to small bulk, and moistened with ammonium carbonate.

The evaporation was then continued to dryness, the ammonia cautiously driven off, and the residue weighed. This gave the alkalies in the form of carbonates, and this weight, added to the insoluble ash previously determined, represents the total carbonate ash.

This method, while yielding carbonate ash, avoids the possible loss of alkalies by volatilisation, and practically corresponds to the method in vogue before the introduction of Scheibler's process.

* This was done in every case to have all the analyses made under the same conditions; in most instances it was imperative, for the inorganic suspended impurities (sand, clay, &c.,) in a sample often weighed more than the total sugar-ash.

As the data thus obtained were carbonate ash determinations of sugars entirely different in their composition from beet sugars, and of a description that, at least to the writer's knowledge, has not been much studied, it was decided to make on them ash determinations according to Scheibler's method in order to learn whether the results yielded by the two methods would correspond.

In order, however, that the determinations should be perfectly parallel, a separate estimation was made in each sugar of the inorganic suspended impurities, and the amount found deducted from the sulphate ash.

The following table exhibits the results obtained:—

Analysis number.	Sugar.	Porlarisation.	Carbonate ash.	Sulphate ash, $-\frac{1}{10}$.	Difference. The Results obtained as sulphates are.—
1.	Dominica Muscovado	86·0	1·25	1·06	—0·19
2.	Java, 2nd product	86·5	1·25	0·99	—0·33
3.	,, ,,	81·8	1·06	0·86	—0·20
4.	,, ,,	86·3	1·05	0·79	—0·26
5.	,, ,,	86·7	0·81	0·62	—0·19
6.	,, ,,	87·5	1·26	0·92	—0·34
7.	Trinidad Concrete	84·0	2·47	2·08	—0·39
8.	Ilo-Ilo	86·6	1·01	1·42	—0·49
9.	,,	80·8	2·30	1·98	—0·32
10.	New Orleans Muscovado.	91·2	0·76	0·49	—0·27
11.	New Orleans Muscovado.	80·2	3·08	2·68	—0·40
12.	New Orleans Melado	79·1	1·69	1·19	—0·50
13.	New Orleans Melado	52·0	1·42	1·09	—0·33
14.	St. Croix Muscovado	88·0	1·27	1·04	—0·23
15.	Ceroons	83·8	1·78	1·25	—0·53
16.	Brazil	84·1	1·95	1·22	—0·73
17.	Java Stroops	77·4	4·16	3·72	—0·44
18.	Mauritius Mol. sugar	86·4	2·87	2·96	+0·09
19.	Superior Cebu Mats	83·2	2·00	1·93	—0·07
20.	Cuba Molasses Sugar	84·2	2·16	2·35	+0·19
21.	Taal Mats	78·5	2·57	1·97	—0·60
22.	Beet, 2nd product	92·2	3·06	2·55	—0·51
23.	Java Basket	96·7	0·77	0·54	—0·23
24.	St. Kitts Muscovado	88·2	1·13	0·87	—0·26
25.	Syrup, Louisiana	40·9	6·80	6·13	—0·67
26.	Syrup, Sandwich Island Sugar	49·2	11·03	10·07	—0·96

The results obtained by the two methods differ very considerably. As the figures yielded by the Scheibler method were almost without exception *lower* than those found by the other process, the suspicion arose that possibly the alkali sulphates might have been partly lost

by volatilisation, although this was very improbable, for the incinerations had all been carried out in a muffle exactly as prescribed.

However, to settle the question, two tests were made. The sulphate ash of the Java sugar was first very carefully determined; then, in test one, there was added to a sample of the sugar, equal in weight to the amount taken for the original ash determination, a known amount of dried and powdered potassium sulphate; test two was carried out in exactly the same manner, only anhydrous sodium sulphate was used instead of the potassium salt. The ash determinations were then carried out as before.

The ash originally present in the sugar was 0·680. In test one, after abstracting the weight of the potassium sulphate which had been added, the ash was 0·680. In test two, after allowing the sodium sulphate, the ash was 0·676, thus proving that the alkali sulphates did not lose in weight by the incineration.

The explanation of these differences must therefore be sought by an analysis of the ash, and the composition of the salts originally present in the sugars must be examined into.

The analyses made showed that the ashes of these sugars contain alkalies (reported in the form of potassium and sodium) ranging from 28·8 to 36·4 per cent.; silica (SiO_2) was present from 1·65 to 11·08 per cent.* Two samples had less than 2 per cent.; three samples had between 2 per cent. and 3 per cent.; two, between 3 per cent. and 4 per cent.; seven, between 4 per cent. and 5 per cent.; three, between 5 per cent. and 6 per cent.; three, between 6 and 7 per cent.; one had 8·93 per cent., and one 11·08 per cent.

The only silicates soluble in water are the silicates of the alkalies; hence one is forced to the conclusion that the alkalies in these sugars are present, at least in part, in the form of silicates. Analysis further showed the ash in most samples to be rich in sulphates, the sulphuric acid (H_2SO) calculated in per centage on the carbonate ash ranging from 4·17 to 31·71 per cent.

How the salts originally present in a sugar are affected by the two methods of ash determination here given is the next question to be considered. The salts in a sugar may be assumed to exist in the form of silicates, sulphates, chlorides, carbonates, phosphates, nitrates,

* This represents silica, or rather silicates *in solution*, as all suspended sand, &c., had been removed by filtration.

and organic acid salts; for instance, as oxalates, tartrates, malates, and possibly as citrates.

	After simple incineration will be found as—	After incineration with sulphuric acid will be found as—
Silicates	silicates	silicates.
Sulphates	sulphates	sulphates.
Chlorides	carbonates*	sulphates.
Nitrates	carbonates	sulphates.
Carbonates	carbonates	sulphates.
Organic acid salts	carbonates	sulphates.

Looking at this table, it is evident that sugars rich in chlorides, carbonates, and organic acid salts, will, on incineration with sulphuric acid, give results that are higher than those obtained by simple carbonisation, because the molecular weight of the sulphates is greater than that of the chlorides or carbonates, into which form (*i.e.*, carbonates) the organic acid salts are transformed by simple incineration.† It was this fact, of course, that Scheibler bore in mind when he called for the substraction of one-tenth from the weight of the sulphate ash; it was this fact, too, that gave rise to the difficulties of the French chemists cited, who found that Schiebler's factor would *not* bring the sulphate ash into agreement with the ash obtained by simple incineration.‡

If, however, the sugars analysed are similar in composition to those here examined; that is to say, if they be rich in silicates and sulphates, the case is an entirely different one, for although it would be extremely difficult, if not impossible, to assign formulæ for the silicates of the alkalies (as those which occur in nature range between the limits $4M_2O,SiO_2$ and $M_2O,2SiO_2$), yet, as the silicates of the alkali metals "dissolve with greater facility in proportion as they contain a larger quantity of base," the molecular weight will, in any case, be equal to, or greater than, that of the alkaline sulphates, and therefore, the substraction of one-tenth will bring the figures below the true value.

(To be continued.)

* Certainly in part, if not wholly.

† That the organic acid salts can be greatly in preponderance appears from analyses made by Laugier, *Comptes Rendus*, 1878, p. 27, who found in analysing the fill-mass of a refinery (fourth product), that over 70 per cent. of the salts present, which themselves amounted to 10 per cent. of the sugar, consisted of organic acids.

‡ In France, at one time, the factor 0·8 was used in official analyses, while 0·9 was adopted in commercial work.

NOTICES OF BOOKS.

Geschichte des Zuckers, seiner Darstellung und Verwendung, seit den altesten Zeiten bis zum Beginne der Rübenzuckerfabrikation. Ein Beitrag zur Kulturgeschichte, von Dr. Edmund O. von Lippmann, Direktor der Zuckerraffinerie Halle. Leipzig: Max Hesse's Verlag, 1890.

This attractive and highly interesting work, by an acknowledged authority in matters relating to sugar, is too comprehensive in its scope and far too copious in its references to admit of our doing justice to it in a short notice. We shall, therefore, reserve to ourselves the pleasure of a much longer notice, with possible quotations, next month, after we have accomplished the task of a thorough perusal, which so remarkable a book deserves. In the meantime, we recommend all interested in the history of sugar, who are sufficiently acquainted with German, to obtain the book at once.

A Guide to the Literature of Sugar: a Book of Reference for Chemists, Librarians, Manufacturers, and Planters, with a comprehensive Subject-Index, by H. Ling Roth. London: Kegan Paul, Trübner & Co., Limited, 1890.

This book, a neat 8vo. of 160 pages, is, as its somewhat peculiar title indicates, a list of some 1,200 books, pamphlets, and papers relating to sugar, the object in view being to include all known works of the character which have a practical or historical value, while excluding mere controversial publications, handbooks of chemistry, and similar works not wholly devoted to the subject. This rather difficult task appears to have been fairly discharged, and the author, who is well known by several publications, the result of several years' experience in Queensland and elsewhere, may be congratulated on having produced an extremely useful book of reference. The classification adopted is alphabetical as regards the authors, where known, and as regards the title, where authorship is unknown or doubtful. In a Bibliography of Sugar from early times down to 1850, by the late Mr. Henry Thorp, which appeared in this periodical in 1884 and 1885, the completion of which has been temporarily interrupted by illness and death—the order adopted was chronological. To those desirous of studying the history of sugar production from original sources this book will be indispensable. Future editions will require a little more care in editing as regards the spelling of foreign words. In the list of periodicals, the *Louisiana Planter* and the *Prager Zuckermarkt* are not quite accurately described.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO APRIL 30TH.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Germany	2,375,329	2,343,645	1,815,443	1,377,780
Holland	167,150	133,023	121,112	72,700
Belgium	391,474	370,900	247,772	190,297
France	31,498	719,655	21,570	441,465
British West Indies & Guiana	766,105	475,278	660,469	368,757
British East Indies	139,049	58,770	86,374	26,161
China and Hong Kong	....	....	....	....
Mauritius	65,997	6,571	61,023	4,925
Spanish West India Islands	34,000	....	28,050	....
Brazil	552,180	121,496	373,947	72,791
Java	479,610	262,460	418,868	201,130
Philippine Islands	138,285	42,100	83,364	20,810
Peru	209,995	265,352	158,882	178,922
Other Countries	225,669	113,787	161,494	80,497
Total of Raw Sugars	5,576,341	4,913,037	4,238,368	3,036,235
Molasses	103,495	97,799	35,367	35,401
Total Sugar and Molasses	....	....	4,273,735	3,071,636
Refined Sugars.				
Germany	1,616,804	1,584,059	1,492,153	1,282,340
Holland	486,362	557,320	457,036	465,702
Belgium	101,017	54,951	98,804	49,281
France	422,943	911,230	388,991	737,616
United States	7,838	3,854	6,742	3,757
Other Countries	*343,258	98	*290,337	73
Total of Refined	2,978,222	3,111,512	2,734,063	2,538,769

EXPORTS.—REFINED SUGARS.

	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Sweden and Norway	30,955	23,651	24,037	16,935
Denmark	44,839	34,751	33,591	21,035
Holland	32,194	28,992	23,395	20,539
Belgium	9,004	9,311	6,084	6,382
France	4,391	4,083	3,204	2,636
Portugal, Azores, & Madeira	23,011	32,516	16,434	21,302
Italy	27,844	32,223	21,248	21,468
Other Countries	49,270	72,772	39,143	54,514
Total of Exports	221,508	238,299	167,136	164,811

* Imported almost entirely from Russia.

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of April, 1890, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1887, 1888, and 1889, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				Apl.	Apl.	Apl.	Monthly Average.				Apl.	Apl.	Apl.	Monthly Average.				Apl.	Apl.	Apl.
	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France.............	1363	1686	1888	3391	1705	1897	3182	5099	4855	3398	7999	2387	2265	3849	6462	6541	5286	11390	4092	4162	7031
Holland	3780	3267	3005	2916	2773	2435	3134	2483	2675	3074	4050	2102	3149	4061	6263	5942	6079	6966	4875	5584	7195
Germany & Austria ..	1347	1510	2964	2804	1686	3403	3177	10463	11729	17245	16997	18482	22938	20774	11810	13239	20209	19801	20168	26341	23951
Belgium	592	622	995	476	491	1074	436	308	227	267	211	150	309	149	900	849	1262	687	641	1383	585
United States	454	8	..	22	..	..	89	2804	157	98	26	301	14	85	3258	165	98	48	301	14	174
Russia.............	3	..	..	..	..	..	..	452	1959	4275	..	5271	953	..	455	1959	4275	..	5271	953	..
Other Countries	..	1	14	..	..	58	..	15	2	10	1	..	7	..	15	3	24	1	..	65	..
Total	7539	7094	8866	9609	6655	8867	10018	21624	21604	28367	29284	28693	29635	28918	29163	28698	37233	38893	35348	38502	38936

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

To May 17th, 1890 and 1889. In Thousands of Tons, to the nearest Thousand.

	Stocks. 1890.	Stocks. 1889.	Deliveries. 1890.	Deliveries. 1889.	Imports. 1890.	Imports. 1889.
London	31	38	106	112	88	118
Liverpool ..	62	62	110	119	86	86
Clyde......	47	53	86	95	93	128
Bristol	2	3	26	25	25	24
Total ..	142	156	328	351	292	356
	Decrease..14		Decrease..23		Decrease ..64	

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Circular.)

For the four principal Ports. In Thousands of Tons, to the nearest Thousand. For April, 1890 and 1889.

	Stocks. May 1st. 1890.	Stocks. May 1st. 1889.	Deliveries. In April. 1890.	Deliveries. In April. 1889.	Imports. In April. 1890.	Imports. In April. 1889.
New York	12	14	97	90	100	85
Boston	1	1	14	18	16	18
Philadelphia....	1	..	31	24	31	24
Baltimore	..	..	..	..	..	..
Total......	14	15	142	132	147	127
	Decrease.. 1		Increase..10		Increase .. 20	
Total for the year			435	375	438	357

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, May 15th, 1890.

Fair Refining.	96o/o Centfs.	Granulated.	Stand. A.	Stock in Four Ports.
May 15, 1890.—4¾c.	5⅜c.	6-6 1-16c.	5⅝-11-16c.	Jan. 1, 1890— 11,169 tons.
May 16, 1889.—6 5-16c.	7¼c.	8¼c.	8¼c.	Jan. 1, 1889— 32,254 tons.
May 17, 1888.—4¾c.	5⅜c.	6¾c.	6 3-16-¼c.	Jan. 1, 1888— 47,798 tons.
May 19, 1887.—4 7-16c.	5⅝c.	5 11-16-¾c	5 5-16c.	Jan. 1, 1887—102,279 tons.
May 20, 1886.—4⅞c.	5⅝c.	6¼-5-16c.	5⅞c.	Jan. 1, 1886— 57,328 tons.
May 21, 1885.—5⅛c.	5 15-16c.	6¾c.	6¼c.	Jan. 1, 1885— 89,186 tons.
May 15, 1884.—5 5-16c.	6⅛c.	7 1-16c.	6⅜c.	Jan. 1, 1884— 60,900 tons.
May 17, 1883.—7⅛c.	7¾c.	8 13-16c.	8⅜c.	Jan. 1, 1883— 50,297 tons.
May 18, 1882.—7⅜c.	8 3-16c.	9¾-⅞c.	9 5-16-⅜c.	Jan. 1, 1882— 43,927 tons.
May 19, 1881.—7 7-16c.	8¼c.	10c.	9½c.	Jan. 1, 1881— 66,990 tons.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 30TH APRIL, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	German Empire.	Austria.	Remaining four principal *entrepôts*.	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
139	235	48	300	173	31	926	616	743

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 30TH APRIL, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	German Empire.	Austria.	Remaining four principal *entrepôts*.	TOTAL 1889-90.	TOTAL 1888-89.	TOTAL 1887-88.
1295	475	46	433	267	359	2875	2815	2657

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.	1886-87. Tons.
German Empire	1,260,000	990,604	959,166	1,012,968
France	800,000	466,767	392,824	485,739
Austria-Hungary	750,000	523,242	428,616	523,059
Russia	470,000	526,387	441,342	487,460
Belgium	210,000	145,804	140,742	135,755
Holland	60,000	46,040	39,280	36,098
Other Countries	80,000	87,000	79,980	69,127
Total	3,630,000	2,785,844	2,481,950	2,750,206

The figures being now practically tolerably well ascertained, we may expect no further changes in Mr. Licht's estimates. The excess over last campaign is thus supposed to be about 844,000 tons.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

During the past month there has been but little activity in cane sugars. Prices at one time indicated a tendency to become firmer, but the close of the month shows almost no change from the end of April. Refined sorts are again lower by 3d. to 9d. Beet sugar, in spite of the large excess production, has maintained its position. A slight advance established at the beginning of the month has been lost, possibly owing to reports that the sowings for next crop may be rather larger than expected a fortnight ago.

The following changes may be noted in the imports for the first four months as compared with 1889:—The total amount was 23,200 tons less, although the total of refined was 6,600 tons more. This year there has been no import from Russia, while France has sent us 24,000 tons more than in 1889; Germany about the same as last year; Italy and Holland somewhat behind. As regards raw sugar, the import from Germany is about the same, that from Holland and Belgium a little less; West Indies, 14,600 tons; East Indies, 4,000 tons; Brazil, 21,000 tons; Java, 10,805 tons; Mauritius and Cuba, 4,700 tons less; while Peru has sent us 3,000 tons, and France 34,000 tons more.

The changes in stocks are:—London, 7,000 tons, and Clyde, 6,000 tons, below the amounts on hand last year; Liverpool, no change. The imports up to the third week in May fall 64,000 tons below those of last year.

Present quotations for the standard qualities, as under, are:—

FLOATING.			Last Month.
Porto Rico, fair to good Refining	12/9 to 13/9	against	12/9 to 13/9.
Cuba Centrifugals, 97°/o polarization	14/3 to 14/6	,,	14/3 to 14/6.
Cuba, fair to good Refining	13/- to 13/6	,,	13/- to 13/6.
Java, No. 14 to 15 D.S...	14/6 to 15/-	,,	14/9 to 15/-.
British West India, fair brown	12/-	,,	12/-
Bahia, low to middling brown	10/3 to 11/-	,,	10/3 to 11/-.
,, Nos. 8 to 9	11/9 to 12/3	,,	11/9 to 12/3.
Pernams, regular to superior Americans..	11/- to 12/9	,,	11/- to 12/9.

LANDED.			Last Month.
Madras Cane Jaggery..	9/9 to 10/-	against	9/6 to 10/-.
Manila Cebu and Ilo Ilo	9/6 to 9/9	,,	9/6 to 9/9.

Paris Loaves, f.o.b...	16/-	against	16/9
Russian Crystals, No. 3, c.i.f.	No business.		
Titlers	18/-	,,	18/3
Tate's Cubes..	19/6	,,	20/-
Beetroot, German and Austrian, 88%, f.o.b.	12/3	,,	12/3¾

THE SUGAR CANE.

No. 252. JULY 1, 1890. Vol. XXII.

☞ The writers alone are responsible for their statements.

CHANGE OF ADDRESS.

All communications to be addressed to "The Editor of the Sugar Cane, Manchester."

For Table of Contents, see page i.

An article on "Sugar Bounties" taken from the *Louisiana Planter* is of value as summarising with tolerable accuracy the statistical position of sugar in certain European countries, though the arguments may be regarded in very different lights by those interested in the question on this side of the water.

The following advertisement has been appearing in some of the leading English papers:—

We, the undersigned Sugar Refiners of New York, U.S.A., hereby give notice that every barrel of sugar exported by us will be marked "This sugar guaranteed not to have been made by the Casamajor process."

Then follow the names of three of the largest refinery establishments.

It is scarcely probable that the Sugar Tariff Bill, which went up to the Senate at the end of last month, will be conclusively dealt with before the present number goes to press. Some weeks must inevitably elapse before this question, which is of very considerable importance to the American sugar planters and manufacturers, as well as to German and French beet-sugar exporters, can be definitely decided. The Commission of the Senate has proposed the adoption of the bill with some amendments, the effect of which will be that in place of sugar up to No. 16 inclusively coming in free, as proposed by the bill sent up from Congress, the grades up to No. 13 only would come

in free, and a duty of about 2s. 8d. would be levied on those grading from 13 to 16. The duty proposed by the bill of the Congress on sugars above No. 16 was about 3s. 7d., the Commission of the Senate proposes one of about 5s. 4d. These terms would much favour the home production, and it is not unlikely the Senate will pass the amendments.

The following, from a Californian paper, is interesting in connection with the efforts now being made to extend the production of beet sugar in the United States. That which most of all puzzles the steady-going Englishman, in connection with statements in American papers, is that everything is regarded in a *couleur de rose* light, and the utmost is made of every little point, until we old-world people get our judgments warped, not being able to make the necessary allowance for the exuberance of our enterprising cousins. These remarks do not especially apply to what follows, but rather to what we have previously heard about beet and sorghum, though the statement that "sugar is now low, and it must advance in price hereafter" is open to objection, both as to containing a *non sequiter* and as being delightfully vague, the word "hereafter" reminding one of the "sweet by-and-bye."

"The returns from two sugar-beet factories in this State, it seems, have been very satisfactory; that is, the owners of the factories have made good profits. Even the factory with the old machinery has done a good business, and its proprietors are so well pleased that they are about to double its working capacity. The farmers who raise the beets are not, however, entirely satisfied with their profits. They believe the factories do not pay as much for the beets as they ought to, and point to the circumstance that the companies are going into raising beets for their mills. If the owners of the mills can make it profitable to raise their own beets and work them up, it shows that the farmers might join together and erect mills which will work up their beets. The sugar business in California is likely to become very profitable, for sugar is now low, and it must advance in price hereafter. What we require is beet-root factories, not large and expensive ones, but those that can work up the beets raised by the farmers in different localities, and for their profit."

The *Sugar Beet*, from which we take the above, contains the following, the concluding argument of which, we are afraid, is not exactly so forcible as it is intended to be. It is true that American

manufacturers of cotton goods have competed on some European markets, but as a matter of fact they could only manage to clear their over-production at a loss.

Several German publications devoted to the beet sugar industry, have been discussing the prospects of the ultimate manufacture of beet sugar in the United States. Their arguments are based upon certain data obtained from Watsonville, Cal., during the first campaign. It is certainly unjust to compare such with those in Germany, where there have been so many years of experience. If, for example, the returns of the first campaign of any factory are compared with those subsequently obtained in the same, it will be seen that the difficulties at first are important factors in the mechanical and financial working of the establishment.

This is so true, that with many stockholders in beet sugar making countries, it is understood in advance that interest on their investment will not be expected for the first year.

Regular delivery of beets, limited supply of water, friction of moving parts of the machinery, requiring frequent stoppage, &c., bad manipulation, from want of experience, are a few of the factors that render a comparison improper with regular returns from a factory of several years' standing in Europe. The labour question in America is a difficult one. We pay our hands more, but it remains to be demonstrated whether we gain as to the comparative amount of work done per individual.

To point out that the total cost of working in California is three times higher than in Germany, using figures obtained under the foregoing conditions leads to a too hasty conclusion. That a factory is new and working by most improved methods, will mean more in a few years to come than at present, without any doubt. We have had in America to compete with the long-experienced working of Manchester cotton mills, and competed we have on every European cotton market. We will do the same with sugar only give us the time.

It is stated that a quantity of the Keni-Keni variety of cane equal to one-ninth of an acre, grown in Barbados in a field along with the regular Bourbon cane, yielded half a hogshead (about 1,300 lbs. net) of muscovado sugar. This result is said to have been obtained with

a defective mill, turned by wind, and with open kettles for evaporation. It is thought by some that careful selection and cultivation of canes would result in obtaining six or even eight tons of sugar to the acre.

A letter to the Jamaica *Gleaner*, which we print this month, is interesting as showing the view held in that island (which is so closely connected by commercial intercourse with the United States) of the Bill now before the American Congress.

Co-operation, or some form of system intended to unite the interests of employés and employed more closely than is thought to be possible under the old relations, and which passes under the name of co-operation, is now the order of the day. We, therefore, do not hesitate to print on page 363 an account which has been communicated to us of a meeting of employés of Clarke, Nickolls & Coombs, Limited, at which appreciation was expressed of the new profit-sharing system introduced lately.

The *Administration des Contributions Indirectes* has just published the results of the present campaign in France up to the end of May. The proportion of sugar (in refined equivalent) obtained from the beetroots is 10·25 per cent. of weight, as compared with 9·55 per cent. in 1889. Last year sugar was worth 57 fr., against 30 fr. this year. The *Journal des Fabricants de Sucre* considers it probable that the total production of the present campaign will be about 690,000 tons in refined. This is below Licht's estimate.

From the beginning of the campaign to the end of May the exports were 122,454 tons (reduced to refined equivalent) against about 75,000 tons in 1889. In the English statistics of imports of raw sugar France now takes the second place, being inferior only to Germany.

Both in France and in Belgium the agitation as regards the proposed new legislation in the sugar duties seems to move (in the former country strongly) in the direction of forcing the refiners to bear a larger share of the burden. This course has been ably advocated by Mons. Dureau, of the *Journal des Fabricants de Sucre*, and is likely to be adopted in both countries. As usual there is

great cry about hardship and prospective ruin; but the onlooker is not able to see things in quite the same light. That the refiners have for many years been making a good thing out of their position is indisputable, but then the fabricants have not done amiss; thanks to the bounty system which now appears to have got a new lease of life as regards, at any rate, all countries but Germany.

The production in Martinique seems to be falling below that of last year. The *Propagateur* says:—"There is a considerable deficit in the sugar exports. Up to the 1st May, 1890, we have, in fact, exported 8,892 barrels less than up to the same date in 1889. Ten years ago we exported from 44,000 to 46,000 tons of sugar, and in 1884 reached 49,000 tons. For some years we have not exceeded 33,000 tons, and for the present year our exports may possibly fall below 30,000 tons. . . . . . . The true evil against which we have to struggle, and which for several years has pressed heavily on our production, is the want of hands, especially just at the time when they are most needed. The complaint is unanimous. There is not a day but its resounds in our ears, a cry of trouble and distress."

The results of the diffusion system as obtained with a battery erected by the Compagnie Fives-Lille at Pointe Simon, in the Island of Martinique, will be found on page 375. It seems to us that there is always something in the way of complete success with the diffusion batteries; whether the reports come from Cuba, or the West Indies, or Louisiana, there is always some drawback present, and we seem constantly to hear the same story of imperfections in the application of the new system and other qualifications of the statements made, which, making all allowance for the difficulties which must inevitably attend the adoption of new systems, would seem to recommend caution. We still think the old mill system is by no means played out. Apropos, we hear from America of the construction of a crushing mill with rollers of hitherto unheard-of dimensions, from which great things are expected.

The Statistical Bureau of the German Sugar Industry (Vereinigung der deutschen Zucker-fabrikanten zur Erhebung statistischer Nachrichten) has just held its second Annual Meeting at Hamburg. The meeting was not numerously attended, and the report expressed

regret at the abstention of some 80 manufactories, who were unwilling as yet to join the union and afford the desired information. On the other hand the formation and support of the Austro-Hungarian and Belgian Bureaux was regarded with satisfaction, as also the probable agreement of the French manufacturers to take similar steps. Some alteration was made in the manner of collecting the information by sending it direct to the Central Bureau, in which case it was thought the objection of many of the factories still declining to join would probably be obviated.

The *Magdeburg Zeitung* speaks hopefully and favourably of the new Zucker-Liquidationskasse, founded to facilitate and put on a safer footing contracts for sugar for delivery, and obviate the swindling transactions which convulsed the market last year. At the same time it is thought that there is not as yet sufficient acquaintance with the arrangements of the new institution.

A new beet sugar factory, with a capital of 1,000,000 kronor (about £56,000), is to be erected in Sweden, in addition to the two factories and one refinery in course of construction at Helsingborg and Krofta-Sockerbruck. Of the above capital, four-fifths have already been subscribed.

On page 355 we give an account of the Continuous Turbine invented by M. Léon Marie, of Martinique, which has already been mentioned by the *Journal des Fabricants de Sucre*, and which is said to effect wonders in turning out a perfectly firm and white and dry sugar. It seems only right to add that the *Sucrerie Indigène*, in quoting the very favourable accounts given of this turbine by the *Propagateur*, adds: "we cannot, until we have received more ample information, fully share the confidence of the writer of the article."

The Swiss Federal Council, in view of the proximate expiration of the treaties of commerce, has drawn up a new scale of customs duties, the modifications of which as far as sugar is concerned consist of a slight advance all round, with the exception of molasses and syrups, the duty on which is considerably reduced.

SORGHUM SUGAR.

In our last month's issue we published a letter addressed to the Editor of the *Indian Agriculturist*, and now we give below a further communication on this subject to the same journal:—

Sir,—In reference to my letter, advising you of the despatch by pattern post, of a sample of "Sorghum sugar," made from the juice of the "Alapore Jowar," I have now the pleasure to forward for publication a paper of instructions for the cultivation of this true sugar sorghum. The purification of the juice by means of *bhindi* (*Hibiscus esculentus*) mucillage is new to me, and does not seem to be known to sugar-cane sugar makers, though the natives may so use it. Any how if this simple product answers in place of bone charcoal it will be of value, as then the Hindoo population will use Shahjehanpore and other sugars now rejected on account of bone charcoal purification. I am much interested in the introduction of this sugar sorghum where the climate suits, and as it matures seed in my garden, altitude 7,000 feet above sea level, it should answer in all Indian Hill stations, and also in Cashmere.

"Daisyburn," Kotgurh. F. P.

The "Alapur Jooar" is a native of the countries bordering on Hunriana and extending to the west towards the Bicaneer territory. It is of two kinds white and red, from both of them good edible sugar can be made. In the year 1883, Captain J. F. Pogson, of the Bengal Army, was pleased to send me some partially black seeds of a kind of "Soorghum Jooar" to experiment upon, and see if any thing could be made of it. On trial, however, it was found to be deficient in saccharine matter. About this time, being on a visit towards Jeypore, I learnt that there was a kind of a jooar called "Alapur," which was extensively cultivated in the aforesaid tracts, and served the double purpose of supplying food and sugar to the natives at the same time. I accordingly procured some seeds of it, and at that gentleman's suggestion sowed them on my estate. At the proper time the juice was pressed and worked in the usual way; it produced fine sugar, equal in every respect to that obtained from the common sugar-cane plant.

This "jooar" prefers a dry sandy soil, very scanty manure, but

the field whereon it is raised must be well ploughed and free from grass, weeds, &c., if more manure is employed, the juice is liable to get acrid; hence it will yield less crystallizing matter. It must be sown not less than a foot apart, early in the month of May or June at latest, in fields previously watered and prepared. When the plants grow up to about 10 or 12 inches from above the ground they must be watered, and then again when they are nearly two feet high if the season is dry and there has been no rain, ortherwise no more irregating is required in case the rains commence early. In order to improve and increase the price, the seed as they appear in bunches on the top must be cut off by a sharp scythe, for if allowed to grow and ripen, the juice will be rendered scanty. When the plant is ripe, about the end of October, it must be watered one or two days previous to pressing, and then pressed in an ordinary sugar-cane mill. The juice as it is extracted is put into large iron boilers called "karah," and refined by a mucillage made of the roots of the well known vegetable called "bhindy," and boiled down to the consistency of "rab" and then put into unused earthen vessels made for the purpose, and stored in a convenient place until the month of December or the middle of January, when it crystallizes and settles at the bottom of the vessels. It is then taken out and all the liquid is then pressed out in the usual way, leaving only the crystallized residue which is placed in vats or pits made of woollen "Kummel" to allow the remaining moisture to trickle down, and over which heaps of "Sewal" (a well known aquatic fern growing spontaneously in all stagnant pools or streams) are placed in a wet state, that chiefly assist the operation of separating all liquid and glutinous matter attaching to it. In about a week on so moving the fern the upper layer will be found to have become dry, this is scraped off only as far as it is found to have dried, and trodden down and dried in the sun in the open air and stored; while a fresh heap of "siwal" is again laid over it and in due time scraped off as before, and so on till until the bottom of the pit is reached. Fresh wet "siwal" must be used every time that the sugar is scraped off. This requires a little experience in sugar making. When raw sugar is thus made, to refine it or make sugar candy out of it is easy enough—every common "hulwaee" can do it. The "Alapore Jooar," like others, shoots up again after being cut and yields a second crop in due time.

INSECT PESTS.

MITES ON THE SUGAR CANE.

As a sequel to an article on the subject of insect pests, published in our issue of October, 1889, we now give the following on mites affecting the sugar cane, (taken from the *Kew Bulletin*,) for which we have not hitherto been able to find space.

"Specimens of mites affecting sugar canes at Barbados were forwarded to Kew by Mr. John R. Bovell, Superintendent of the Dodd's Botanical Station. The mites were found to affect specimen canes under experimental trial at the Station, as well as on two neighbouring estates. It was estimated by Mr. Bovell that canes affected with mites would yield only about one ton of sugar per acre, as against three tons per acre from unaffected canes growing on the same estates under identical conditions in regard to soil, manure, and tillage. The mites are very minute, and usually live under the leaf-sheaths of the canes. They are doubtless present in many other sugar-producing countries, but have escaped notice. The specimens received from Barbados have been very exhaustively examined by Mr. A. D. Michael, F.L.S., who has kindly prepared the following valuable report on the subject:—

"Mr. Bovell's excellently packed box reached me with the various creatures alive, and apparently uninjured. I found upon the canes five sorts of acari, viz.:—

"1. *Histiostoma rostro-serratus.*—This is a small, opaque, white mite often found in great numbers. It may be disregarded, as it is a follower, not a causer of decay. It is only useful to mention it, in order that it may not be mistaken for the real enemy. The best drawing of it I know is in a paper by Mégnin, 'Mêmoire anatomique et zoologique sur un Nouvel Acarien de la famile des Sarcopsides, &c.,' in Robin's *Journal de l'Anatomie et de la Physiologie*, 1876, p. 369.

"2. Numerous forms of immature *gamasidæ.*—These are friends, being predatory creatures, doubtless present to feed upon the real destroyers. The *gamasidæ* vary greatly, but drawings of type species may be found in any book on *acari.*

"3. The *damæus* or *notaspis*, originally sent by Mr. Bovell.—This I found in all stages, and from the position in which it was found and the parts it was feeding on, I am decidedly of opinion, as Mr. Bovell supposes, they were doing damage. But in the canes sent the number of these *acari* are small—certainly not sufficient to

account for the extensive damage spoken of by Mr. Bovell; and, looking at the analogy of the allied species, I am still of opinion that this species is probably not the principal cause of the evil.

"4. Two species of *tarsonymus.*—*Acari* of this genus are almost invariably great destroyers of vegetable life. They are extremely minute and almost transparent, and, therefore, are likely to escape the notice of anyone except a practised microscopist, or a person specially looking for them and provided with sufficient microscopical instruments. These *tarsonymi* were absolutely swarming upon every sample of the cane sent; they were in all stages. They were chiefly found in the axils of the leaves. The larger species is certainly identical with the *acarus* which Dr. Bancroft found doing such serious damage to the growing sugar cane in Queensland, and which is unnamed, but ought fairly to be called *tarsonymus bancrofti.* Dr. Bancroft evidently had not sufficient knowledge of the *acarina* to know what family his mite belonged to, but he appended drawings to his report, which are good, and render the nature of the creature quite unmistakable (2nd Annual Report of the Board appointed to inquire into the causes of Diseases affecting Live Stock and Plants. Queensland, 1877). I believe this *tarsonymus* to be the principal destroyer. There are present in the canes (in addition to the *acari*) a large number of *anguillulæ.* It should not be forgotten that although these are probably as a rule followers of decay yet they are often causers of it.

"All the specimens of cane sent were in a tolerably advanced stage of the disease, and consequently of decay. It would be well worth Mr. Bovell's while to examine specimens in which the disease was only just commencing, and even the neighbouring canes which still appeared healthy, so as to ascertain, if possible, which creature commences the evil. If he has not the means of doing this, I should be happy to assist him.

"With regard to the important questions of how to cure the evil the same means would probably be applicable to the *damæus* and the *tarsonymus.* The latter would be more easy to destroy than the former, as the hard cuticle of the adult *damæus* is practically impervious to chemi als. Boiling water and dessication are at once destructive of life in both species. These means, however, of course cannot be employed on the canes, but might sometimes be useful with infected material to be used as dressings, &c. The means

employed by Dr. Bancroft were steeping the canes before planting in carbolic acid and water for 24 hours. The strength he was trying was 1lb. of acid to 100 gallons of water; he also tried prolonged immersion in lime dip (milk of lime). These means are probably as good as any that can be adopted, but a mixture of powdered sulphur in soap and water is also a very good destroyer of this class of life. Whatever chemicals be employed I would suggest that it would be desirable, where possible, instead of applying the remedy once only, to do so two or three times at intervals of, say, a fortnight, because the eggs of *acari* have a shell which, as a rule, is quite impenetrable to chemicals, and, therefore, although the larvæ and adults may be destroyed, the eggs survive; and to really clear the plant it is necessary to catch the larvæ when they emerge from these eggs. Of course, infected *débris* should be burned.

"As Mr. Michael's very complete investigation also incidentally clears up what was doubtful in the long mysterious "Red Rust" of the Queensland canes, it will be convenient to reprint here from the Kew reports for 1877 and 1878, the account therein given of its investigation.

"*Extract from the Report on the Conditions and Progress of the Royal Gardens, Kew, during the year 1887, pp. 37—38.*

"The disease which I mentioned in my last report as having inflicted great injury on the sugar cane in Queensland (where it is known as "rust") has engaged a good deal of our attention. The examination of the numerous documents, both printed and written, which have come into my hands, as well as of the specimens of diseased cane, unfortunately far from satisfactory, which have been transmitted to us from the Colony, have led to the following conclusions, which have already been communicated to the Queensland Government:—

"1. It appears not improbable that the disease is identical with one which had been noticed in the Malayan Archipelago, and in Mauritius [Journal Royal Agricultural Society, New Series, vol. ii., pp. cxxxi.-cxxxii.], in the Society Islands according to Professor Liversedge, and in Bahia [Journal Royal Horticultural Society, New Series, vol. iii., pp. 14–17].

"2. It is recognised by the appearance on the leaves of red spots known as "rust," which increases in number till the whole leaf

withers, and ultimately dies. When the leaf is stripped off, there is usually found inside the sheath and upon the stem a patch of dark brown or reddish incrustation.

"Professor Liversedge, of the University of Sydney, has studied the disease, and attributes it to defective conditions of cultivation. He considers that the marks on the leaves, and the red incrustations on the stem, are caused by a fungus of the family *Æcidiacei*, but that its attacks are the effect and not the cause of the disease. Professor Liversedge also noted the presence of acari, which he believed fed on the fungi.

3. "Dr. Bancroft, in a paper presented to the Queensland Parliament in 1876, distinguished between the disease as affecting the leaf and stem. He found that the red spots on the leaves eventually produced a fungus with black spores, and he attributed the spots to its attacks. The red incrustation on the stem he also believed to be fungoid, but was unable to throw any further light upon its cause; he detected mites (acari) at the injured spots.

"4. In a subsequent paper, Dr. Bancroft (*Sugar Cane*, 1877, pp. 476–480) has shown, I think, most conclusively that the red incrustation is the result of the attack of an acarus which infests the young shoots of the diseased sugar cane in immense numbers.

"5. The specimens sent to this country had been carefully examined before Dr. Bancroft's paper appeared here in print. The Rev. M. J. Berkeley and Mr. Broome, two well-known cryptogamists, satisfied themselves that the red incrustation was in no way due to a fungus, and were disposed to attribute it to the attack of a coccus.

"6. Specimens were then submitted to Mr. McLachlan, F.R.S., by whom they were sent to M. Signoret, the best living authority on the *Coccidæ*. He arrived at the opinion that the red incrustation was not the work of a *coccus*, a view in which Mr. McLachlan concurred. On a further examination of some of the specimens Mr. McLachlan stated in a letter (September 14th, 1877) that he had found 'myriads of what may be collapsed acari.'

"7. This was independent of, and so far confirmatory of the observations made by Dr. Bancroft. I think, therefore, that it is probable that the true cause of the so-called 'rust' has now been detected. The sugar cane being grown from joints, the acarus would easily be communicated from one crop to another. Dr. Bancroft finds that steeping the joints in milk of lime destroys the acarus, and probably

a mixture of two to four ounces of fluid carbolic acid to a gallon of water would be still more effective.

"8. The black spored fungus eventually produced by the red spots on the leaves is regarded by Mr. Berkeley as a new species, to which he has given the name of *Dupazea sacchari;* he does not consider that it plays any part in the disease, but simply takes possession of the already moribund tissues.

"*Extract from the Report on the Progress and Condition of the Royal Gardens, Kew, during the year 1878, pp. 48-49.*

"In the Kew Report for 1877 the history of the various insect pests which had proved so injurious to the sugar cane in Queensland was given in some detail.

"During the past year a further correspondence has taken place upon the subject between this establishment and the Colonial Office, and a large series of specimens, carefully selected and sent over to this country in various preservative fluids by Mr. J. T. Staiger, F.L.S., Government Analytical Chemist, has received for examination.

"It appears now to be placed beyond question that the 'rust' is due to the puncture of a minute acarus which exists upon the diseased cane in myriads. The exact scientific determination of this parasite would be, as I am informed by Mr. McLachlan, F.R.S., who has again most obligingly assisted us in this matter, a point requiring research of some difficulty. Mr. McLachlan states, however, that the 'creature looks very like a *Tyroglyphus*, but the habits do not altogether accord with those of that genus.'

"I am to state that the treatment with lime suggested by Dr. Bancroft, and that with carbolic acid recommended in the Kew Report for 1877 (p. 38), promise to be quite effectual in keeping this pest under control. Mr. MacKay reports to the Legislative Council of Queensland the results of experiments upon diseased canes subjected to the following treatment directed by Dr. Bancroft, which I quote here as likely to be efficacious in other Colonies:—

"'1. Clean the joints entirely from all trash as carefully as possible. 2. Immerse for 24 hours in water and carbolic acid at a temperature to bear the hand,—1 lb. of acid to 50 gallons of water. 3. Make milk of lime,—2 lbs of lime to 1 gallon of water; immerse the plants in this for a few minutes. 4. Lift out and spread in the sun, turning them over to dry for one day before planting.

"Out of 24 different varieties of cane so treated, I am glad to

say that all except two have come up sound and healthy, and the two are but lightly touched with the disease, a few spots only showing on the outer ends of the leaves, while the heart of the cane is quite green and healthy. The old stools or roots from which were taken the plants so treated have all come up diseased, some of them died out, so that there can be no doubt that the mixture had its effect.'"

THE SUGAR INDUSTRY OF THE WEST INDIES.

LETTER TO THE EDITOR OF THE "JAMAICA GLEANER."

Sir,—The American Tariff on Sugar "Bill" before the United States Congress promises to make free of duty sugar and molasses below the No. 16 D.S. of colour; and all above it dutiable at the rate of 4-10th of a halfpenny (cent) per pound, and also to grant a bounty of one penny (2 cents) per pound to be paid from the Treasury for a period of fifteen years on sugar made in the States to polarise 85%. The political views demanding such a bill are of little consequence to the trade of the West Indies, and it is left to us to find out how far such legislation will affect the interests of sugar dealers in general. Those directly interested in the sugar industry of Jamaica, who ship their sugars to America, ought to know on what lines their interests will be protected from further depression of trade, observing the effect of the European bounty system on the West Indian trade. All these bounty systems should be regarded with the eye of suspicion, especially when the political views of the nation granting it is not clearly understood. "Will you walk into my parlour, said the spider to the fly;" taking care how you do walk in may be to the advantage of the invited, who knows best his own purpose. The Bill does not define intelligibly enough the relative degree of purity of the sugar to the Dutch Standard of colour on which the duty is assessed. The purity of the commercial sugars of the West Indies ranges from 85 to 96%. The No. 13 D.S. of colour ranges by the polariscope from 72 to 75% pure sugar; whilst the No. 20 D.S. of colour represents 100, or all pure sugar. The standard of colour represents graduates, by one, for every four degrees from 75% pure sugar. A standard scale might be drawn thus:—

Dutch Standard No.	·0 ..	Polarizing	100 all sugar.
Dutiable 4/0	,, 19 ..	,,	96 to 99%.
	,, 18 ..	,,	92 ,, 95%.
c. per lb. ..	,, 17 ..	,,	88 ,, 91%.

2c. per lb. Bounty To admit duty free.	No. 16 ..	Polarizing	84 to 87%.
	,, 15 ..	,,	80 ,, 83%.
	,, 14 ..	,,	76 ,, 79%.
	,, 13 ..	,,	72 ,, 75%.

The advantage of such a scale is apparent. To manufacture uniformly any quantity of sugar depends entirely on the skill of the sugar boiler and the tact he displays in making the desired grade; the colour depends mainly on the mode of operation on the cane juice in the clarifiers. Concrete sugars of No. 13 D.S. appear to be the foundation of the grades; it is simply the cane juice boiled with lime without clarification into a semi-solid crude mass of sugar, sugar-dirt, and molasses, as product for the refineries. The masse cuite of muscovado differs widely from the "concrete," it does not grade below No. 14 D.S. of 76 to 79% pure sugar. The masse cuite of vacuum pan, however, might be made of a low grade colour, but higher percentage of saccharine strength to the taste of the manufacturer with impunity. To admit duty free certain classes of sugar, and at the same time to grant a bounty up to the same class, does not appear to me to be for the benefit of the nation nor yet the Treasury; hence the reason that the attempt to place things as they are is hard to be explained by any other but the Yankee himself. The duty paid just now is about £10 per ton, while the Treasury is offering the bounty of £8 6s. 8d. in lieu thereof. Is it not then necessary that something should be done in time in the interest of the sugar industry of the West Indies? What guarantee have you got that the aim of Americans is not to give the fatal blow to the enterprise in the West Indies within the next fifteen years? Have you forgotten how America worked her independence of Britain? I tell you, remember how Esau sold his birth-right too for a mess of pottage when he was hungry. What will Jamaica do should it be the intention of the Americans to purchase the country for its salvation? Otherwise, as regards the American sugar market and the prevailing low price, Jamaica might supply it with sugars to order only, on condition that the market quotations all round be raised equivalent to the bounty prescribed in the tariff for the term of fifteen years; letting the grocers continue to pay the duty on importations according to order. Should this be carried out, the sugar industry of Jamaica would hold its own in the face of the crafty legislation of the American Government.—Yours,

ELLIS BARTON.

SUGAR BOUNTIES.

From the *Louisiana Planter.*

There has always been something seductive about bounties, and they became so popular during our late civil war that we developed the professional bounty jumper. He wanted the bounty first, last, and all the time, and some of our sugar people feel that way now. They would clutch this *ignis fatuus* with both hands, and yet they would find it eluding their grasp.

It has become quite common to say that France, Germany, and Austria have been and are now developing their sugar industries by bounties. A bounty is a premium given to encourage or promote any object, and neither France, Germany, nor Austria have been developing their sugar industries that way. When Napoleon strove to develop the industry in France nearly a century ago, he resorted to bounties, but during all later years any benefits received by the sugar producers from the Government have come as an incident of the laws and not as their main object.

In France the Government has estimated the yield of sugar from the beets at $7\frac{3}{4}$ per cent., and has levied its excise taxes on that basis, making an additional charge on the excess in yield over the official figure of $7\frac{3}{4}$ per cent. The French Government also assumes that 4 per cent. of molasses is made, and that from this molasses 14 per cent. of sugar can be made, or $\frac{56}{100}$ per cent of the weight of the beet.

The Government levies a tax of $5\frac{45}{100}$ cents per pound on the $7\frac{3}{4}$ per cent. of sugar officially assumed as the yield from the beets and a tax of $1\frac{82}{100}$ cents per pound on the ascertained excess in yield. The actual average yield at present is $10\frac{1}{2}$ per cent. of refined sugar from the beets and $\frac{56}{100}$ per cent. from the molasses, and hence the tax amounts as follows, viz. :—

	Dols. cnts.
One ton of beets, official yield of sugar, 155 pounds, @ $5 45c.	8 45
Excess of yield, 66 pounds, @ $1 82c.	1 20
Total	$9 65

The drawback allowed when sugar is exported is made on the basis of the official yield of $7\frac{3}{4}$ per cent., which is taxed $5\frac{45}{100}$ cents per pound, but as this is allowed on all the sugar exported, it includes that portion taxed but $1\frac{82}{100}$ cents per pound—*i.e.*, the *excess* in

production over the official figure, and as this excess amounts to nearly one-half and is taxed but one-third of the rate applied to the official yield, it gets triple the rebate the rest does and triple what it paid, and herein lies the so-called bounty.

We have shown the tax on the ton of beets based on the present average results to be \$9·65. The 221 pounds of refined sugar, the present average yield per ton of beets, that has paid this tax, is allowed a rebate of $5\frac{45}{100}$ cents per pound on exportation, or \$12·04, making a premium or *bounty* of \$2·39 on every ton of beets, or of $1\frac{8}{100}$ cents per pound of sugar produced.

Of course, the home market is determined by the results of the exported portion of the crop, and the whole list of prices floats up to the common level, and the French consumer pays for his sugar the current prices of the world, plus his home tax or duty of $5\frac{45}{100}$ cents per pound. The American consumer is 3 cents per pound better off to-day, under *our* existing schedule.

In Germany the tax on beets is \$1·77 per ton. The average yield of pure sugar is 12 per cent., or 240 pounds per ton of beets, and hence this first tax is equal to $\frac{74}{100}$ cent. per pound of sugar.

A drawback is allowed on sugar exported above 98 per cent. test of $1\frac{8}{100}$ cents per pound, making in the case of Germany a premium or bounty of $\frac{35}{100}$ cents per pound.

In Austria the system is somewhat more complex, having been based upon the capacity of the diffusion cells, and any excess of work done by the cells gave the factory that much sugar free of the excise tax, and thus came the Austrian bounty.

In the figures we have given for France and Germany the average yields have been considered, but it becomes evident at a glance that the best factories get still far more bounty as they excel so much in the yield they get.

The sugar industry of continental Europe has sprung into such enormous proportions and has become such a conspicuous factor in the wealth of the various nations, that their astute statesmen, recognising now the fact that their existing tax and tariff schedules result in practical bounties to producers, still refuse to change their systems, notwithstanding the fact that the English Government has been trying for years to induce such a change. It is admitted that the agricultural people of Europe have been enormously aided and improved by their new sugar culture, and it would seem the height

of unwisdom to take any retrogressive steps or in any manner to peril the good condition brought about by their wise legislation.

American agriculture demands similar and equal consideration, and in no other direction is there such promise of quick relief as what may come from sugar production. Kansas claims that no other crop is so certain in her lands of limited rainfall. Nebraska has come to the front, is building a splendid factory, and will build a dozen more, if adverse legislation does not paralyze her. California has led the van in successful beet sugar work, and now Colorado, Oregon, and Washington are claiming that they, too, want to engage in the work.

In the south, Florida, with its vast area of fertile lands so readily reclaimed, has been surprisingly successful in sugar manufacture from the start, and the probable development of the sugar industry there during the next twenty years, if undisturbed by adverse legislation, would be beyond any present conception.

Louisiana, when she shall reduce her unruly mistress, the Mississippi, to law and order, can quickly double, triple, yes, quadruple her sugar crop, and, if reasonably protected, could, in a score of years, reach a production equal to the present consumption of the nation.

If every friend of American sugar will study all these points, and will use all proper effort to sustain and advance the industry, we shall be that much more certain of success, and we shall the sooner reach it.

THE PROSPECTS FOR THE COMING BEET SUGAR CAMPAIGN.

(From the *Berliner Tageblatt.*)

The state of the beet fields must be considered as good in every European country where beets are cultivated. In the interests of the agriculturists one can only wish that the good prospects for the coming crop may continue, for only in this case is it possible, as we have seen in the last campaign, for the manufacturers to make a profit even with beets at moderate prices. Not so much in consideration of the favourable prospects for the coming crop as in view of the increased area of cultivation in all countries, the prices of new sugar for delivery, October to December, have slowly receded by 75 pf. since the middle of February. If the yield per acre were the same as in the preceding year, the increased cultivation in Europe would give the following results:—

			Tons.
Germany	5	per cent. more	= 63,000
Austria	10	,, ,,	= 75,000
France..	10	,, ,,	= 80,000
Russia	8	,, ,,	= 37,500
Other countries	$2\frac{1}{2}$	,, ,,	= 3,500
Total			259,000

The European sugar crop for 1890-91 would then read 3,890,000 tons,* against 3,630,000 tons in the preceding year. The picture of the future which is thus presented for the present would probably have produced a much greater effect on the market, had it not been for the visibly increasing consumption, and the great demand from North America, which may be expected if the new Sugar Tariff Bill should be passed.—(This was written before the Report of the Commission of the Senate had been brought in.—Ed. *Sugar Cane.*)

THE MARIE CONTINUOUS TURBINE.

(From the *Propagateur* of Martinique.)

Two months ago we announced, on the authority of a correspondent, that the Continuous Turbine invented by our countryman, M. Léon Marie, had finally emerged from the period of experiment and essay, and entered on the domain of industrial facts. Since then it has gone on steadily, and we have had an opportunity of seeing it at work, delivering its sugar with the regularity of a machine already long in use, from which no unexpected surprises need be feared.

The Marie Turbine—we give it the name of its inventor, to whom the colonial sugar industry already owes the oven for burning bagasse, and the use of anhydrous sulphate of lime, and the *décanteur*—deserves special description.

It is a drum or vat of 1·50 metres high. In this revolves a basket, the motion of which is regulated from above. At the upper orifice the masse-cuite is supplied by a continuous band. At the inferior orifice the sugar issues white, dry, and cold, also without interruption. A mechanical movement, which cannot be thrown out of gear, which does not come within the limits of our description because it is the secret of the inventor and because its simplicity is almost amusing, causes the sugar which is borne along in the wild rush of

* This figure is about the same as Mr. Licht's.

the turbine to descend vertically along the filtering wall of the basket. In the two upper divisions of the basket the sugar is cleaned, and throws off its molasses, which a special pipe conducts to the boiling of the inferior products. In the lower division the steam is introduced and the clarification commences.

An ingenious arrangement allows the amount of steam to be accurately proportioned to the work to be done. If finer sugar, such as that of Trois-Rivières generally is, has to be clarified, then so little steam is introduced that one might well ask if there really is any. If, on the contrary, very coarse sugars of the second or third jet have to be dealt with, the apparatus is equal to the occasion, and can do all that is required.

One of the most economical arrangements of the continuous turbine is the following:—

In the operation of turbining, there are two successive phases: the removal of the molasses, and then the bleaching, *i.e.*, the clarification of the sugar. The latter is effected by the introduction of a jet of steam into the basket. This steam, impelled by the centrifugal force, strikes on the sugar which is already cleared of its molasses, dissolves a portion of it, which, in the form of clear syrup or *cleare*, filters through the mass, and carries off from the crystals the small quantities of molasses which adhere to them. This can evidently only be effected to the detriment of a portion of the crystallised sugar. In ordinary practice, and with the existing apparatus, this sugar is not lost, but mingles with the larger quantity of the molasses, and only figures among the inferior products of the works. In the Marie turbine things are quite different. The clearing steam, introduced at the proper quarter, only meets the sugar after it has been purged of its molasses, and the *cleare* runs off by a special pipe in the state of a fine clarified syrup almost completely deprived of its green syrup, which is immediately returned to the boiling of the first jet.

There is another most ingenious device in this turbine. The rotation movement is utilised; one portion of the apparatus acts as a ventilator, and produces a rather strong current of air from below upwards. The air supplied meets first the dry but hot sugar, and cools it. It next meets the clarifying steam, and carries it along with it in its ascending movement, as opposed to the sugar which descends. This steam raises the temperature of the masse-cuite, and renders its molasses more fluid, that is, more easy to detach, and by this well

contrived combination, the condensations, instead of, as in the ordinary turbine, taking place to the detriment of the crystals which have already been purified, improve the sugar which is coloured by adhering molasses.

Our good fortune led us to Trois-Rivières just at the time when several proprietors and managers of works, sugar chemists and others interested in the manufacture were present, and it is rather the impressions of these competent persons than our own, which we are about to give in enumerating the principal advantages offered by the turbine of M. Léon Marie.

Every grain of sugar that issues from the machine is dry and white; no brown lumps imperfectly clarified in the centre to lower the colour and the polarisation; the evenness of the product is remarkable.

The sugar issues cold from the turbine, and the construction of the apparatus is such that one might, if desired, place below it, to catch the product, the hogshead in which it was to be conveyed to market. There are then no depreciations or rebates to fear, consequences which too frequently follow when sugar is put hot into the cask. The numerous causes of lose are thus removed.

By the separation of the *cleare* along with the molasses, all the *cleare*, not only of the first but of the second, third, and fourth jets is sent back to the boiling of the first jet, for the clearing syrups of the inferior product are very nearly as fine as the first jet, and thus there is a certainty that no melted sugar will be left in the last molasses. All these causes united cannot fail to produce a notable improvement in the yield of sugar.

To this advantage is added the very tangible one of doing away with manual labour. A factory having 20 ordinary turbines will be able to a great extent to replace them by three or four of these machines, which once properly started will require no more superintendance than the other machines in the factory. One person will thus replace, with very great saving, twenty or twenty-five pairs of hands, to the greater benefit of our agriculture.

One of our most experienced manufacturers remarked to us that the problem of continuous turbining which had been so long before the sugar industry, with all its advantages, but also with all its difficulties, has been radically solved, for the Marie Turbine is so ingenious and so simple in its conception, that it cannot fail to be practical.

ON THE DETERMINATION OF ASH IN RAW SUGARS.

By F. G. Wiechmann, Ph.D.

(Continued from page 330.)

To illustrate this, the following table, while bringing once more the carbonate ash values previously recorded, gives the sulphate ash values as found; that is to say, *without substraction of one-tenth*, but of course, as before, allowing for the inorganic suspended impurities.

Analysis number.	Sugar.	Polarisation.	Carbonate ash.	Sulphate ash.	Difference. The results obtained as sulphates are:—
1.	Dominica Muscovado	86·0	1·25	1·21	—0·05
2.	Java, 2nd product	86·5	1·32	1·25	—0·07
3.	,, ,,	88·8	1·06	0·90	—0·16
4.	,, ,,	86·6	1·05	0·89	—0·16
5.	,, ,,	86·7	0·81	0·68	—0·13
6.	,, ,,	87·5	1·26	1·04	—0·22
7.	Trinidad Concrete	84·0	2·47	2·32	—0·15
8.	Ilo-Ilo	86·6	1·91	1·60	—0·31
9.	,,	80·8	2·30	2·20	—0·10
10.	New Orleans Muscovado.	91·2	0·76	0·56	—0·20
11.	,, ,,	80·2	3·08	2·98	—0·10
12.	New Orleans Melado	79·1	1·69	1·73	×0·04
13.	,, ,,	52·0	1·42	1·23	—0·19
14.	St. Croix Muscovado	88·0	1·27	1·16	—0·11
15.	Ceroons	83·8	1·78	1·44	—0·34
16.	Brazil	84·1	1·95	1·44	—0·51
17.	Java Stroops	77·4	4·16	4·15	—0·01
18.	Mauritius Mol. Sugar	86·4	2·87	3·33	×0·46
19.	Superior Cebu Mats	83·2	2·00	2·24	×0·24
20.	Cuba Molasses Sugar	84·2	2·15	2·67	×0·51
21.	Taal Mats	78·5	2·57	2·44	—0·13
22.	Beet, 2nd product	92·2	3·06	2·85	—0·21
23.	Java Basket	96·7	0·77	0·61	—0·16
24.	St. Kitts Muscovado	88·2	1·13	0·98	—0·15
25.	Syrup, Louisiana	40·9	6·80	6·82	×0·02
26.	Syrup, Sandwich Island Sugar	49·2	11·03	11·19	×0·16

It will be seen at a glance how much better the results of the two methods agree now; but even so, the sulphate ash is, with few exceptions, *lower* than the other, and, therefore, if anything, one feels tempted to seek for a factor by which to *increase* the sulphate ash. The exceptions noted are the very ones to prove the rule, or rather to bear out the explanation given, for Nos. 26, 18, and 19 are lowest in silica, containing respectively 0·96, 1·64, and 1·69 per cent. Nos. 20 contains 2·64 per cent. silica, but is the lowest in sulphates, and so these sugars in their composition approach more closely the beet sugars examined by the European chemists, the ash analysis of which, made by Von Lippmann, may be regarded as typical. In this analysis (of a carbonate ash of beet-sugar) he reports among other constituents,—

Potassium	50·87
Sodium	9·13
Sulphuric acid	2·04
Silicic acid	0·10

In view of the important part that the ash plays in the cost and in the yield of raw sugars, it is certainly a matter of no small consideration to have an analytical method which may be depended upon.

To devise an analytical process by which the *actual amount of salts* in a sugar could be ascertained in every-day practice, that is to say, by which the salts present could be quickly and accurately determined, seems, in our present state of knowledge, an impossibility, unless, indeed, the electric-conducting power of dilute sugar solutions shall prove to be the means by which this end will be attained.

Whether any of the numerous methods proposed for determination of the ash—as, for instance, Dubrunfaut's suggestion of burning the sugars off with spongy platinum, ignition in a current of pure oxygen, or the combustion with oxide of zinc, as recently recommended by Lucien—would prove superior to Scheibler's method, cannot here be inquired into.

The great advantage of incineration with sulphuric acid, especially as it is now practised, with addition of a little ether, is not to be questioned. The possible objection as to the expense of platinum muffles, where several must be used on account of the number of daily determinations, has been overcome in our laboratory by the use of muffles made of Russian sheet-iron, which may be had at one-hundredth the cost of the platinum ware, which last, on an average,

between three and four months, and which give absolutely no contamination to the sugar ashes burned off in them.

While thus fully appreciating this analytical method, there is no reason why countenance should be lent to the practice of changing an *absolute value* obtained by analysis into a *problematical figure* by means of a factor which may give results concordant, too high or too low, according to the nature of the sugar examined, and which, as far as this item is concerned, leaves to the purchaser really no clue as to how his sugars will turn out. Why not accept, as already suggested by Dubrunfaut, as a working factor the sulphate ash actually obtained? This, at least, represents a definite value upon which calculation may be based, and it is difficult to understand how the one-tenth substraction can have held its sway to the present day, when its misleading influence—at least in one direction—was pointed out already ten years ago.

THE "SEREH" DISEASE IN THE CANE.

We have at various times (see especially *Sugar Cane* for November, 1889, and January, 1890,) referred to the disease in the cane which has been so destructive in Java. It appears that the attention of Dr. F. Benecke, of Samarang, in Java, has in some way been called to the investigation by Professor Harrison, of Barbados, with regard to the raising of cane from seed (see *Sugar Cane* for October, 1889, and April and May, 1890), and he has written to Professor Harrison respecting the discoveries of the late Dr. Soltwedel, which we noticed in our October, 1889, number above-mentioned. At the same time he has sent to Professor Harrison Dr. Soltwedel's pamphlet on "sereh," and given a description of the characteristic signs of the disease, which we now append, as it is very necessary for all connected with the cultivation of the cane, to be able to recognise the malady if it should unfortunately appear.

Symptoms of the "Sereh" Disease, as given by Dr. Benecke.

"My aim is to enumerate in the following notes whatever are considered symptoms of the 'sereh' without, however, wishing to maintain that all these are really symptoms of the 'sereh.' In

reality they now call every diseased appearance of the sugar cane 'sereh,' and thereby cause the greatest confusion.

"The diseased appearances which may be observed here on the *saccharum officinarum* are, among others, the following:—

"1. Low (often only 3 to 4 decimeters—12 to 16 inches—high), shrubby growth, *i.e.*, many shoots crowded together. Therewith the leaves are oblong, and at one time narrow, at another out of all proportion broad. From this shrub-like shape with very narrow leaves comes the derivation of the name, as in that case our cane resembles the 'andropogon schoenanthus,' the Javanese name for which is 'sereh.'

"2. Fan-shaped arrangement (position) of leaves, arising from the shortening of the internodes.

"3. In the case of severely sereh-sick plants, which are only a few decimeters high, the internodes are occasionally only 1 to 2 centimeters ($\frac{1}{3}$ to $\frac{2}{3}$ inch) long, more particularly the knots (nodes) are tinted strongly red, so as to present in the longitudinal section the appearance of a ladder with red rungs.

"4. Formation of numerous aerial roots.

"5. These roots are unable to pierce through the leaf-sheath, but frequently bend inside of the same.

"6. The fibro-vascular bundles of the stem are strongly tinged with red.

"7. Numerous super-terraneous outbranchings.

"8. Sheaths and root-buds below these are dyed vermilion; frequently also the stem itself is. (The red-edged colour I take to be normal when the roots are exposed to the light.)

"9. Formation of wax on the stem is said not to occur.

"10. Sticking together of the leaf-sheath and the stalk.

"11. Growing part of the stalk is frequently dyed highly red.

"12. Ratoons (called here 'bibit') rot in the ground and become red right through.

"14. Accumulation of secondary organisms, for instance many insects, fungi, &c., &c."

ECONOMY IN SEED CANE.

A letter in the *Louisiana Planter* from the well known pen of Mr. Santiago Dod, contains a hint which may not be without value, and we therefore extract the portion in question:—

"It will perhaps not be amiss to call attention here to a plan advocated by Mr. Reynoso, which would perhaps solve the whole problem of seed cane in Louisiana if the cost of labour in effecting the work should not prove too great—that of using solely the subterranean stalks for planting instead of the cane itself. The plan consists in ploughing out the old stoles, keeping them in water for twenty-four hours (or longer if necessary) in order to cleanse them of earth, separating the germs, and planting them in the furrow like seed cane. It is atated on good authority that a stalk of cane will in one day absorb ·18 of its own weight of water, and if this be true, the subterranean ones will in all likelihood do the same, and the immersion would perhaps insure germination. There would be no expense whatever attending this system apart from the labour employed, as the stoles would be taken from the old fields about to be destroyed for replanting. A large part of the work might be accomplished by boys, and with practice might be lessened far more than might at first be expected. The saving of the whole cost and labour of preserving seed cane would certainly go far in compensating the additional work of planting by this method. Each plant in Cuba is said to furnish a very large number of these subterranean stalks, of which every joint is supposed to be available, and Mr. Reynoso obtained fine stoles from single germs. He proposed sowing them in the furrow in sufficient number to attain any desired "stand."

"This system of reproduction promises so many advantages that it seems at least deserving of repeated trials upon a limited scale, for if successful, the favourable circumstance of having an abundance of water always at hand would give Louisiana a decided advantage over most of her competitors."

CAPITAL AND LABOUR.

The employés of Messrs. Clarke, Nickolls and Coombs, Limited, met the directors of this company at the Eton Mission Hall, on the 3rd of June last, to present to them an illuminated address, expressing their appreciation of the new profit-sharing scheme with workpeople. The company employs over 1,000 workpeople, and has been paying 10% dividends on the ordinary shares. At the last general meeting of shareholders it was unanimously resolved that in future the surplus profits (after paying 6% dividend on the ordinary shares) should be divided equally between the workpeople and the ordinary shareholders. In presenting the address satisfaction was expressed regarding the general policy of the directors towards employés, and a hope that the mutual good feeling which exists between employer and employed might continue.

The chairman, Mr. Geo. Mathieson, suitably replied on behalf of the board, warmly thanking the employés for the address. In the course of his remarks he said that the profit-sharing scheme inaugurated in the works was based on sound commercial principles, and if given a fair trial by the employés, certain to materially benefit them. It was based on principles more truly co-operative than those of the large distributive stores, which had undoubtedly been of benefit to working people in many places and in the inception of its constitution more liberal than other profit-sharing schemes in operation elsewhere. Although competition in the confectionary business was keen and profits meagre, yet if employers and employés alike worked unitedly, and with confidence together, he was convinced that a satisfactory result would be achieved.

Mr. Horn said that the success or failure of the scheme was certain to have far-reaching results, and appealed to all present to strive earnestly to make it successful, not only in their own interests, but in the interest of their class. He pointed out that even were the scheme to miscarry, they (the employés) could not by any conceivable means be losers, while if it succeeded, which he was certain it would do, they would reap very considerable benefits. They would still be at liberty to join or form a trade union, and they could, as in the past, leave their employment at a minute's notice if they so wished. He also clearly showed how they could save the company at least £3,000 per annum through economising time and material.

Mr. Coombs, in the course of a humourous speech, impressed on the employés the necessity of putting their heart into their work. The company did not look for harder physical work under profit-sharing, but if all the employés worked for the company's interest with their heads as well as with their hands success was a foregone conclusion. They must remember now that of every shilling extra profit made, or waste saved, sixpence belonged to the employés, and any economies effected would be for their benefit.

The hearty and frequent applause which interrupted the speakers conclusively proved the sympathy of all present. Upwards of 900 attended.

SUMMARY OF CONCLUSIONS ARRIVED AT ON THE ACTION OF MANURES DURING THE YEARS 1885-89, INCLUSIVE.*

1. The addition of readily available nitrogen to mineral manures produces a large increase in the weight of canes grown, but excessive dressings (over three cwts. of sulphate of ammonia per acre) may cause a marked decrease in the richness and purity of the juice.

2. Under certain climatic conditions manuring with nitrogen in form of slowly decomposing organic matter, may if applied before, or soon after the planting of the canes produce excellent results. Applications of such slow acting manures in June or July, at the period of the sugar canes most active growth, are unadvisable and may result in considerable loss. (See 1888 report.)

3. Upon the soil and under the climatic conditions existing at Dodds during the years 1885 to 1889, both inclusive, nitrate of soda was markedly inferior to sulphate of ammonia as a source of nitrogen for the sugar cane.

4. The profitable employment of purely nitrogenous manures depends largely upon the state of the soil. If the soil is in good heart such applications may realise heavy returns, if poor such manuring will result in heavy loss.

5. For the maximum return of sugar cane by manuring, phosphates must be present in the manures used.

6. If such phosphates are applied in the form of superphosphate of lime great care must be exercised in their use and application, as

* From the Report for 1889 on the Experimental Work at Dodds' Botanical Station, Barbados, by J. B. Harrison and J. R. Bovell.

whilst light dressing of superphosphates capable of supplying 75 or 80 lbs. per acre of "soluble phosphates" to the acre (equivalent to from 16 to 18 per cent. of "soluble phosphates" in commercial sugar cane manures when applied at the rate of one ton to five acres), may produce large increases in the weights of canes, etc., heavier dressings do not produce corresponding increases, and excessive ones may even reduce the produce below that obtained from manuring with nitrogen and potash only.

7. The use of insoluble phosphates, such as precipitated and mineral phosphates, is not advisable during the canes' period of active growth, but may produce excellent results when applied to the soil at an early period, in a very fine state of sub-division, in large quantities and uniformly mixed with it. To obtain, however, equally profitable results with these phosphates as with moderate applications of superphosphate, it is absolutely necessary that they be purchaseable at far lower prices than they can be at present obtained in this island.

8. The additions of potash to manurings of phosphates and nitrogen produces in soils at all deficient in available potash large increases in the yield of canes and of available sugar in the juice per acre.

9. The most advantageous time for the application of potash containing manures appears to be at the earliest stages of the cane's growth, and pecuniarily the use at this period of so called early cane or potassic manures is far preferable to that of even the highest quality of manures which were formerly used.

10. The presence of an excess of potash in the manures does not injuriously affect the purity of the juice either by increasing the glucose or appreciably the amount of potash salts contained in it.

11. No definite information has been obtained with regard to the influence of the mineral constituents of the sugar cane manures upon the saccharine richness of the canes, although in the great majority of cases canes receiving potassic manurings have been somewhat richer in sugar than those otherwise manured. It appears, therefore, probable that increased saccharine richness in the sugar cane must be sought in the cultivation of varieties, the careful selection of tops for planting from healthy and vigorous canes (by this selection whilst the saccharine strength of the best canes of a variety would not be increased the average might be greatly raised), and possibly by the seminal re-production of carefully selected canes and varieties.

As we have already remarked, in the *Sugar Cane* for May, the best results appear to have been obtained, as in preceding years, from the use of Ohlendorff's Early Cane or Potassic manures, used in conjunction with dissolved Peruvian guano, as will be seen from the following comparative table extracted from the Official Report:—

	PER ACRE.		
	Weight of produce. Tons. Cwt.	Increase by manure. lbs. available Sugar.	Profit by manuring, per acre.
SERIES A.			
Plot 1.—Ohlendorff's Early Cane Manure	45 8·8	2,540	$23·60
,, 4.—Vickers' do. do.	42 19·6	1,971	15·06
,, 5.—Thorne's do. do.	44 4·8	1,850	13·25
,, 6.—Bert's do. do. No. I.	42 17·9	2,380	21·20
,, 7.—Bert's do. do. ,, II.	46 6·5	2,195	18·42
SERIES B.			
Plot 1.—Ohlendorff's Early Cane Manure, and Ohlendorff's Dissolved Peruvian Guano	42 6·2	3,172	$29·08
,, 4.—Thorne's Early Cane Manure, and Cane Manure	42 12·	2,784	24·26

NOTICES OF BOOKS.

GESCHICHTE DES ZUCKERS, SEINER DARSTELLUNG UND VERWENDUNG, SEIT DEN ÄLTESTEN ZEITEN BIS ZUM BEGINNE DER RÜBENZUCKERFABRIKATION. Ein Beitrag zur Kulturgeschichte, von Dr. Edmund O. von Lippmann, Direktor der Zuckerraffinerie Halle. Leipzig: Max Hesse's Verlag, 1890.

(Second notice.)

This very interesting and valuable work, of which we have already given a preliminary notice, is another instance of the laborious application and unwearied assiduity which our German friends bring to bear on nearly every question which they study, and which is too often wanting in our countrymen. The Englishman seems to possess above all things a great power of rapid generalisation, and the ability to sum up matters and see the root and central point of a matter, so as to decide quickly on the desirable mode of action and to perceive promptly where his interest lies. But in matters of detail he is too often defective, impatient, careless, and even slovenly. No doubt this is to some extent born of too much prosperity and want of competition in the past, but it is precisely in this very point of detail that the German excels; we believe the German intellect to be slower

than the British, but it is, on the average, indisputably surer, and whether this is a national characteristic, or, as we are inclined to think, a faculty acquired by careful and conscientious school-training, it behoves John Bull to take a lesson, in this respect above all, from his Teutonic relatives.

The book under notice is a fine sample of patient research combined with great technical knowledge and acumen. The author has carefully and conscientiously given, not only the names of the authorities from which he has derived most of his information, but also the date and place of publication, so that the reader may, if so inclined, verify every statement. The history is brought down to, but not continued beyond, the date of the commencement of the beet sugar industry, for two reasons, firstly, that to take in the latter would have demanded too much space, and secondly, because the history of beet sugar has already been, if not exhaustively, yet in its broader outlines fully treated on.

Commencing with a substance of a somewhat similar nature, the use of which must have preceded the discovery of cane sugar, *i.e.*, honey, the various allusions to which in Sanscrit, Greek, Egyptian, and Latin authors, as also the etymological connections and various forms of the Sanscrit root *Madhu* (German, *meth;* English, *mead;* Swedish, *mjöd*) are traced, the author proceeds to treat of the "Home of the sugar cane and the preparation of raw sugar." He quotes Decandolle and Miquel to the effect that it is undoubtedly a fact that the whole of the wild kinds of the genus *Saccharum*, perhaps with one single exception, belong to India. The whole of the varieties of the true sugar cane (Saccharum officinarum) even those which by many botanists are regarded as independent varieties, as, for instance, the Chinese sugar cane (Saccharum sinense) point to the same origin. Botanical reasons also require us to look for the home of the sugar cane in India, and the occurrence of almost every wild variety of saccharum in Bengal, the oldest name of which—Gaura or Gauda—is derived from guda or raw sugar (modern, *goor?*) and whose inhabitants call themselves "the men of the red sugar cane," points in the same direction.

The original stock of the sugar cane is, we are told, no longer known, nor is it believed to exist in a wild state. This deduction is based on the united testimony of all who have written on the subject. Dr. von Lippmann alludes to the idea formerly prevalent

that the sugar cane was *apogamous*, and to the experiments and discoveries of Soltwedel and Harrison, but does not consider that any of these shake the theory of an Indian origin.

The mention of sugar in the earlier Indian writings, the Institutes of Manu, and the great epics of the *Mahâbhârata* and the *Râmâyana* is alluded to, and the probable age of these discussed, and the names applied to the sugar cane and its juice are given. As regards the time when solid sugar was first manufactured only two data can be given, viz., the reception of sugar cane as tribute in China in the 4th century, and a remark of Hiuen-Thsang, who travelled in India in the first half of the 7th century, distinctly mentioning both syrup and solid sugar, as also the fact that solid sugar was obtained in Northern Indian from the sugar cane. From these Dr. von Lippmann deduces the opinion that the discovery of solid sugar must have taken place between the 4th aud 7th centuries, nearer the latter than the former. The 3rd section treats of the sugar cane and sugar in Europe in ancient times and the earlier portion of the middle ages, commencing with Heroditus, Ctesias, Aristotle, and Nearchos, and Onesicritos, including also Arabian authors, and discussing in some fifty pages the various mentions of sugar, and the possibility that they refer to manna or similar substances.

Twenty-five pages are next devoted to the consideration of the various mentions of sugar in connection with the Courts of the Khalifs, after which a section of similar length treats of the western provinces of the Khalifate. The author points out that the Hebrew Scriptures (Bible and Talmud, the latter closing in the 6th century) know nothing of the sugar cane, the first mention of it being found in the "Halachoth gedoloth" of Rabbi Simon of Kahira (about 900 A.D.), from which time the "Halacha" writings frequently speak both of the juice, and also solid sugar and conserved fruits. It is considered probable that the Arabs introduced the sugar cane into Egypt at the time of the conquest by Amru in the middle of the 7th century; the author also shows that the same people brought it into Sicily about 830 A.D., and into Spain about the middle of the 8th century.

The Arab writers of the 11th century give details of the mode of planting the cane and of the manufacture of sugar. "Abul-chair informs us that the cane is cut when it is ripe and good in January, it is then sliced in small pieces pounded in mortars or in some similar

manner pressed in a mill, and the juice put upon the fire in a clean cauldron. It is then boiled, taken off the fire and strained, and then boiled once more till it is reduced to one-fourth. Cup-shaped moulds made of earthenware are then filled with this, it is placed in the shade until it is solid, and finally knocked out of the moulds, dried in the shade and stored, the residue of the cane which remains after pressing is eaten by horses, they are very fond of it and fatten on it."

Translations of many quotations from Arabian and Persian poets are appended to this section, some of them highly interesting, in which sugar plays a prominent part in the imagery employed.

The 7th section is devoted to the spread of the sugar cane to China and the coasts of the Further Indian and Chinese Seas, which appears to have taken place about the 7th and 8th centuries.

In the next section, that entitled "Sugar at the time of the Crusades," is an interesting dissertation, founded on the studies of Littré, Diez, Grimm and others, on the word sugar in various European tongues.

From the original Indian form *çarkarâ*, which in Prakrit became *sakkarâ* (the habit being to drop the letter r before a consonant, and replace it by reduplication of the following consonant) was formed the Arabic *sukkar*. This word naturally became the parent of all the different forms such as—azucar (Spanish, from alsukkar, pronounced assukkar), assukar (Portuguese), zucchero (Italian), chuchre (Provençal), chucre (old French), sucre (French), zukura (old German), zucker (German), zocker (Flemish), suyker (Dutch), sokkar (Swedish), syker (old Norse), sukker (Danish), sachar (Russian), cukier (Polish), cukorus (Lithuanian), cukra (Bohemian), czukor (Hungarian), shicker (Mongol), shakara (Tibetan), shakar (Persian), shachara and shukar (Armenian) sheker (Turkish). The middle Latin contained as many as 28 forms, varying from chuchra to sachara, zockra, zaccarum, and zukurum, the last agreeing most nearly with the usual Latin form saccharum.

The 9th section brings us to the sugar consumption of Europe in the 14th and 15th centuries, and the people who were its commercial distributors. And here we begin to feel tempted to quote such passages as the following, taken from the "Voyage d'oultremer en Jhérusalem" of the French traveller Caulmont, who passed through Sicily in 1418 :—" Know that in this town of Palermo they make much sugar, and that I was very desirous of seeing how this was done. So my

conductor took me to a house where the said sugar was manufactured; the sugar cane grows in the fields, and the stalks look like hemp stalks, they also resemble them, but full of sap, and they grow, as people say, twice annually. The cane is gathered, cut into small pieces, and taken to a stone mill, which is turned by a horse moving in a circle as is done with our oil presses; and when it is well crushed and broken up it is well pressed in a wooden press; all the juice which runs out goes into a cauldron and is well boiled in these, which are placed on a mighty stove in which huge blocks of wood are burned. When it is thoroughly boiled it is allowed to run through linen sacks, and passes into small earthenware moulds in which it cools and sets. As soon as it is quite solid it has become sugar, and this is the way they make sugar; but a large number of vessels and utensils are required for this, which cost much money."

As regards the various words used for the different forms of sugar, Dr. von Lippmann has again shown great diligence and assiduity in collecting the various forms and indicating where they came from. Muscovado (Italian, moscovata; French, moscouade) is found under the names musciatto, musquado, mosquato, moscado, moscobado, moschiado. The Spanish form is "assucar mascabado," coming direct from the verb menoscabar or mascabar, to deteriorate, make poorer, and the word was in those days applied to the poorest quality of Egyptian sugar.

In English the earliest mention of sugar is in Chaucer (second half of the 14th century), in the "Rhyme of Sir Thopas" and in the "Miller's Tale."

The tenth section treats of "Sugar in the Age of Discovery," beginning with the second half of the 15th century and the fall of Constantinople, which diverted commerce, and with it the sugar trade, from its original channels.

The Canary Islands, which had been known to the Romans, were rediscovered about 1300, and about 1350 the Azores and Madeira were found, and in the year 1420 sugar cane was planted in Madeira and succeeded admirably. Manardus, of Ferrara (who levied from 1462 to 1536), gives in his "Epist. Medicinal" the following account of the manufacture of sugar, which was of course founded on the Sicilian method:—

"The cane is broken small, pounded, or boiled down, but in large factories it is pressed out, the juice purified, clarified, and thickened,

and the raw mass separated from the syrup, which is allowed to run off; the sugar is, as a rule, boiled three times, becoming each time better and purer, and after the third boiling hard, and very white and brilliant; in order to make candy as clear and transparent as alum, it is boiled four or five times. According to the number of boilings so are the intermediate qualities; none of them are as good and cheap as the 1½lb. Valencia loaves, white as snow, and ringing when struck, but the Madeira loaves of 6lbs. to 10lbs. weight are somewhat like these; the 10lbs. to 12lbs. Canary loaves are much inferior, not quite white, and if you buy the poorer sorts they are reddish inside and contain syrup. Such stuff is deliquescent, and of no use for making dry conserves, and in the course of transport a thick syrup often runs from it, which is frequently boiled over again together with sugar clearing, &c. The worst loaves, although these also were refined by means of wood ashes, were those from St. Thomas, they could rarely be kept for any length of time, and at the furthest they become deliquescent."

The author shows, that contrary to a very widely spread opinion, neither in the period under notice, nor before the end of the 18th century, was there any appreciable amount of East Indian sugar brought to European markets. The following is so interesting that we translate in full:—

"During the 16th century England obtained by far the greatest portion of her sugar from Venice and Lisbon, partly direct and partly through Antwerp, the great emporium for all merchandise destined for the north of Europe; prices of sugar, which had fallen considerably towards the end of the 15th century, went up in consequence of the decay of the Egyptian trade, and the cessation of production in that country; from 1515 to 1540 it almost doubled in price, and as the imports from Madeira, Mexico, Domingo, and Brazil were for a long time incapable of supplying the deficiency caused by the loss of the Egyptian supply, sugar continued dear, and the consumption, which had become considerable, made very slow progress. It remained, however, of sufficient importance to give an impetus to the establishment of refineries in England. According to Stow's 'Survey of London,' the first were erected in 1544, but did only a poor trade, as they were unable to contend with the Antwerp boiling-houses, which worked better and cheaper. Not until the fall of Antwerp, and the destruction of its commercial prosperity did they begin to flourish, and

in the first twenty years made so much money, that several new refineries were erected about 1590. In 1596 Sir Thomas Mildmay begged for the grant of a sugar monopoly, which was refused by Queen Elizabeth. Portuguese raw sugar was principally used, but in 1563 American sugar also began to come into the London market."

Much learning is employed by Dr. von Lippmann in detailing the great use that was made of sugar in medicine, the various properties that were ascribed to it, and the medicinal effects supposed to follow its use. These are more interesting to the student of medicine and medical science than to our regular readers, but want of space alone compels us to omit several quotations of passages that have proved very pleasant reading.

The 11th section is of interest as treating of the manufacture of sugar in America in the 17th and 18th centuries. We are conducted to Brazil, and the circumstances of its earlier history examined, especially in connection with the Dutch conquest of several portions. At the time this took place, there were 166 sugar mills in operation. The total annual production was about 1,000,000 arrobas, equal to about 250,000 cwt., of which nearly one-third was of the commonest quality.

When the Dutch gave up Brazil in 1654 about 20,000 of them remained in the country, but a year after the Portuguese Government turned them out, to the great loss of the country as regarded sugar production, and opened the way to a competition on the part of the exiles, who went to the West Indies, that eventually proved too much for Brazil.

The author proceeds to trace the history and development of the West India trade in sugar, which was effected under the direction of these Dutchmen in St. Christopher, Jamaica, Martinique, and Guadeloupe. The details given are so numerous and extensive that we can only refer our readers to the book itself, which it is to be hoped may soon appear in an English form. In the 12th section the "Sugar Consumption of Europe in the 17th and 18th centuries" is treated of, and here again the detail is so laborious and the statements are so interdependent and continuous, that we are unable to quote or do more than recommend these thirty pages to careful study.

The 13th section contains a historical description of sugar refining in Europe in the 17 and 18th and the beginning of the 19th centuries. The 14th section is devoted to a short résumé of what is known

about sugar manufacture in the East since the beginning of the 14th century, the details respecting later years are however but few. The 15th, 16th, and 17th, contain respectively: "Substitutes for Cane Sugar"; "History of Sugar Prices"—extremely interesting—and "Opinions as to the Origin and Nature of Sugar."

The fact, that in this last section not even the opinions and remarks of ancient and modern philosophers regarding sugar, have been overlooked, is another and striking proof of the thoroughness and comprehensiveness of the work, in which we have been able to detect no errors, not even in the spelling of words and names which are by no means of daily occurrence. We have been often tempted to quote when our limited space forbade the indulgence, but we think the table of dates relating to the geographical spread of the cultivation of the sugar cane may be interesting and useful for future reference, and therefore venture to append it, as Dr. Von Lippmann in this case, as always, gives his authority for each date.

CHRONOLGICAL TABLE OF THE GEOGRAPHICAL EXTENSION OF THE SUGAR CANE.

Date. About B.C.	Country or District.	Authority.
327	Beyond the Ganges..	Nearchos.
250	China	?
A.D.		
1	East India Islands (Java)	?
400	Cashmir, Thibet	Fa Hian.
450	Gondisapûr	Moses Chorenensis.
600	Ceylon	Ritter.
643	Egypt	
680	Syria (Damascus)..	
700	Cyprus	Mas-Latrie.
700	Cambodja	Abel-Rémusat.
700	Socotra .. .. .?	Massudi.
709	Morocco	Dozy.
714	Spain..	Reed.
750	Provence	Beer.
818	Crete	
827	Sicily	Gibbon.
850	Madagascar	Soleiman.
850	Andamans, Nikobar Island	Soleiman.
900	Tyre, Tripoli, &c.	Istachri, Mukadassi.
900	Tabaristan, Balkh	Istachri.
1100	Zanzibar	Edrisi.

Date. About B.C.	Country or District.	Authority.
1100	Morea	Ritter.
1200	Majorca	Pegolotti.
1420	Madeira	Barros.
1480	Canaries, St. Thomas	Peschel, Knapp.
1493 } 1514 }	Domingo	Kolumbus, Pviedo.
1520	Mexico	Humboldt.
1524	Cabul, Tiflis, Oxus	Babur.
1532	Brazil	Handelmann.
1533	Peru	Cieza.
1549	Provence	Olivier de Serres.
1580	Hispaniola	Humboldt.
1580	Paraguay	Volz.
1620	Argentine Republic	Volz.
1630	Guadeloupe, Martinique	Moseley.
1640	St. Christopher	Moseley.
1641	Barbadoes	Ligon.
1644	Bourbon	Ritter.
1673	Louisiana	
1712	Mauritius	Ritter.
1770	Japan	Thunberg.
1785	Pennsylvania	Poppe.
1850	Australia	Beer.
1850	Natal	Ritter.
1852	Madeira	Grisebach.

KRONBERG'S PATENTROLLEN FUR VOLKSWIRTHSCHAFTLICH WICHTIGE INDUSTRIEZWEIGE UND EINTRAGLICHE PATENTGEBIETE. Band 1 ILLUSTRIRTE PATENTROLLE DER ZUCKERINDUSTRIE (Illustrated Patent-Roll of the Sugar Industry.) Berlin: Verlag von W. H. Kuhl, 1890.

The author, recognising, in face of the constantly increasing number of German patents (over 50,000 having been granted since 1877), the necessity of some dependable list of those yet remaining in force, has decided on issuing a series of such lists, each applicable to a different industry. Of these the present and very neat and handy little volume is the first, and is rendered more attractive, though, perhaps not more useful, by a number of illustrations of several of the more important apparatus for which patents are still running.

The usefulness of such a book must naturally to a large extent be confined to those interested in beet sugar machinery, but it is a valuable little work of reference for all who may have need of reliable information on the patents yet in force in Germany. Although the period of 15 years, the longest for which German patents are granted, would bring us from 1877, the time of the establishment of the German Patent Office, to 1892, yet already many of the patents once in force are beginning to expire, so that this work will become an absolute necessity to those studying the question of German patents. The arrangement appears to be good, and the information sufficiently detailed for the purpose desired.

DIFFUSION AT POINTE-SIMON (MARTINIQUE).

(From the *Sucrerie Indigène.*)

The study which I made during several hours of the diffusion system, as in operation at Pointe-Simon, leaves no doubt, in the minds of those most competent to judge, that the results which will very shortly be obtained can no longer be contested, as has been the case up to now. The diffusion apparatus supplied by the Fives Lille Company is admirably arranged and works wonderfully, taking from 10 to 12,000 kilos (10 to 12 tons) of cane per hour, equal to 250 to 300 tons per 24 hours, although, if I am not mistaken, they have never got beyond 175 tons. The result is that there are stoppages and intermissions of the diffusion process which are very injurious. The apparatus is stopped several times a day for want of crushed cane. On the other hand when the crushing is good for some hours there is an abundant supply of juice, and the triple-effect is no longer equal to the occasion, thus falling from Charybdis into Scylla.

The diluted juice passes alternately into 12 of the existing 16 diffusors, because there are always several in course of charging and unloading. The slices give up about 88 per cent of this juice, and when they have passed through the mill they are so dry as to be available at once for feeding four boilers, the other four are heated by coal. The diluted juice issuing from the last diffusor has a density of 5° B, which appears to me to be rather weak for a normal juice of about 8° density.

Nevertheless, and in spite of the imperfections still existing in the

application of this new mode of working, the result obtained has been 7·35 of first jet, equal to 1½ per cent., on the average, more than when the mill is used.

The consumption of coal was about 10 tons per day. This is in great part to be ascribed to the too great dilution of the juice and the defective quality of the boilers (which do not supply their full contingent of pressure), also to the triple-effect being insufficient, primary causes which occasion frequent stoppages in the works, always at the expense of greater consumption of fuel.

Competent men willingly admit that with a new boiler of 160 cub. metr., this consumption of coal could be reduced by half. The results of diffusion might be thus put down as the absolute payment for the material, forming the profit of the first campaign.

The material at Pointe-Simon cost 150,000 francs (£6,000), being the purchase money, to which must be added the cost of putting up, &c. The above item might now be reduced to 120,000 francs (£4,800).

REPORT OF THE SUGAR EXPERIMENT STATION OF THE LOUISIANA STATE UNIVERSITY AND A. AND M. COLLEGE, AT AUDUBON PARK, NEW ORLEANS, DA.

Wm. C. Stubbs, Ph.D., Director.

Just before going to press we have received the above Report. The Field Experiments, extending over four years, have comprised questions relating to:—1. Germination; 2. Physiology; 3. Varieties adapted to Louisiana; 4. Manurial requirements. The first and last questions are so exceedingly interesting in connection with the experiments in Barbados, that we give in this month's number all for which we can find room, leaving the rest to follow in our August issue:—

Field Experiments.

With the end of the present season closes a series of experiments begun four years ago. It was contemplated in the beginning to extend them through five years, but the removal of this station from its old location near Kenner, to its new domicile at this place, has shortened the time.

These four years have been patiently spent in repeating the same experiments upon the same soil, and the aggregate results are far more suggestive and conclusive than those reached in one year.

The bulletin will contain therefore, a summary of the results of the four years, together with the detailed results of 1889. In comparing the yearly results, the different seasons must be known and considered.

The winter of 1886 was very severe, destroying much of the seed and stubble, the spring was late and cold, and good stands of cane were not obtained till May. The subsequent seasons were fair, and where good stands prevailed the crop was medium.

The winter of 1887 was mild and conducive to excellent seed cane, the spring was moderately dry and warm; followed by a warm and wet summer grading into a cool dry autumn; conditions favourable to heavy tonnage.

The winter of 1888 was fairly propitious, but the spring was excessively wet, preventing the proper cultivation of the cane. The wet weather extended to July, causing a serious postponement or abandonment of the regular "lay-by" of cane. These rains were succeeded by a dry, cool fall, giving us light tonnage, but heavy sugar yield, due more to the low glucose content than excess of sugar in cane.

The year 1889 will always be remembered as the year of drouth. The rainfall for the year was only forty-six inches, and this fell mostly in the winter and summer, giving us a spring and fall of unexampled dryness—a dryness which has been prolonged into the winter of 1889, and up to this time has scarcely been broken.

We find that a dry, warm winter, followed by a moderately dry spring, and this, in turn, succeeded by a hot wet summer, shading gradually into a cool dry autumn, are conditions favourable to a maximum growth of cane.

GERMINATING QUESTION.

The sugar cane has been so long cultivated from cuttings that it has, like the banana, lost its power of producing ordinary true seed, even though it passes through all the phases of fructification. Often in nature, when any organ is rendered useless, it ceases to exist. The fish in underground caverns are eyeless. The banana and some other plants, long propagated from shoots or suckers, produce seedless fruits. In the last year or two, however, the cane has been made to produce true seed. The idea by which this result was achieved, was in itself a simple one, yet the thought may produce a revolution in cane culture. Professors Harrison and Bovell, of Dodd's Reforma-

tory, Barbadoes, conceived the idea that by placing in close proximity unlike varieties of cane from different parts of the world, by cross fertilisation, perfect fructification might result.

Experiments have verified this conception, and to-day a large num ber of true seedlings are growing (some on this station from seed kindly furnished by Professor Bovell), and already several new varieties of great promise have been named and propagated. This discovery is of great value, since the cane plant, hitherto so refractory and susceptible to change only through bud variation, now becomes a pliant tool in the hands of the scientist, and soon we may expect varieties of great excellence as the result of the labours of the latter. Pending these researches and experiments, the Louisiana planters must continue to utilise a goodly part of each crop as seed, and economy often suggests the propriety of planting the upper part of the stalk so poor in sugar, instead of the entire stalk, so valuable at the mill. This practice is, however, severely criticised by some, upon reasons drawn from known principles of vegetable physiology. The cane, say they, has only sterile flowers, and consequently gives no seed or grains. Therefore the eyes of the cane are intended to replace the true seed or grain. In all seed bearing plants, those seed germinate and fructify best which are permitted to reach perfect maturity. Therefore, in imitation of this natural law, we must seek that part of the stalk which contains the largest and best developed eyes in order to secure seed which will produce the most vigorous plants. It is further claimed that where tops are universally used as seed a degeneracy of the cane will follow, since the latter is always reproduced with those parts of the cane where the juices are poorest in nourishment (sugar) and the eyes most imperfectly developed. Hence, it is a practice with some of our planters never to plant fall cane until the polariscope shows at least 10 per cent. sugar in the cane. *Per contra* there are others who claim that the planting of the tops is justifiable from purely scientific reasons, besides the economy involved.

They regard the cane planting as "cuttings," rather than true seed, and the eyes as buds to be developed under proper conditions. They say that the florists when he wants to root new plants, never uses the old or mature wood, but rather the young and succulent portion. Therefore in planting cane the youngest and most succulent portions will secure the best results. Which is right has not yet been

decided by science. Experiments in the field have demonstrated that eyes from both the mature and immature parts of the stalk will germinate. But which are the best, *i.e.*, which will ensure the best and surest results under the varying conditions of our seasons, soils, and rainfall?

To determine this question experiments were instituted, with a view of continuing them through a series of years in order to eliminate as far as possible all the modifying factors incident to one year's experiment. Great pains were taken to select healthy stalks of uniform length. These were cut up into short pieces, beginning with the green immature top. Two eyes were left upon each cutting, and each stalk was selected so as to give eleven cuttings. Seventy-five of these cuttings, containing 150 eyes, were devoted to each experiment.

The land was in excellent order, having had a large crop of pea vines turned in early in the fall with a four-horse plough. The cuttings were carefully deposited in each row, and covered by a hoe.

The following table will give the aggregate yield and the available sugar on 70 per cent. extraction per acre for the three years :—

	Yield. Tons.	Available Sugar. Pounds.
1. Upper White Joint	35·01	4,332
2. Next to White Joint	61·47	7,631
3. Next to No. 2	72·27	8,812
4. Next to No. 3	71·84	8,497
5. Next to No. 4	63·89	7,582
6. Next to No. 5	71·71	9,228
7. Next to No. 6	67·36	8,387
8. Next to No. 7	62·03	6,235
9. Next to No. 8	55·67	5,717
10. Next to No. 9	37·37	4,018

CONCLUSIONS.

Here No. 3 has given the largest tonnage and next to No. 6 the largest available sugar. The upper white joints germinate much more quickly than the others, but these sprouts are incapable of withstanding prolonged droughts in early life. Many of these sprouts died in 1886, and the stubble crops were therefore "gappy." Again, the stubble of No. 5 was somewhat injured in 1888 by driving carts over it to obtain cane from the experiments beyond, and hence its yield was very low in 1889.

These experiments clearly show that the upper portion of the cane, barring the green, immature joints, is the equal if not the superior of the whole cane, or any other portion for seed, and suggests the propriety of search for some practical way of utilizing the upper thirds of the entire crop for seed and grinding the other two-thirds.

(Continued next month).

Correspondence.

VIRTUE IN HIGH FARMING.

TO THE EDITOR OF "THE SUGAR CANE."

There is common sense in the proverb, "It is useless to cry over spilt milk." It can be adopted to other circumstances than spilt milk, for it is equally foolish to cry over the injustice that has been done, and is being done by the Mother Country to her cane sugar producing colonies. The British Empire is so large that probably the colonies have suffered not only by known and palpable injustice, but by want of a proper knowledge of its several parts. It is the prerogative alone of the Great First Cause to regulate both the grand and the insignificant. We lost Java and Cuba from the want of knowledge of their importance on the part of the ministers of the Crown. British Guiana has been spoken of as an island, and one nobleman, when appointed as Colonial Minister, had to purchase a map that he might learn where the provinces were over which he had to rule. Those proprietors of cane sugar estates who have weathered the past, and are still weathering the present storm, have ceased to cry over the spilt milk. They have put their shoulders to the wheel. They have erected new machinery for crushing the cane. In the island of Barbados, where, 25 years ago, the steam mills could have been counted by the fingers of one hand, there are probably now ten or more where one existed. The cultivation of the soil too has received greater attention. It has been analysed, and the artificial composts too, sent out from home, have been subjected to the same process, and, when found wanting, have been rejected. It is not only an unjust but a cruel proceeding to sell a poor planter an adulterated article. That day happily has passed. Manures of all kinds are now

subjected to analysis, and that, with the improved machinery, has resulted in giving the island much larger average crops. Latterly too the island has been blessed with a succession of genial seasons, so that it has held its own, notwithstanding the beet sugar bounties. Of course the weak have gone to the wall, and new owners, buying a bankrupt stock, at bankrupt prices, may be able to keep what they have lately bought; but the salvation of all, both the strong and the weak, depends upon the proper cultivation of the soil. A ton and a half per acre will not answer. Every effort must be made to get at least two tons of sugar per acre. Upon such a return, if the estate is otherwise conducted economically, a bare living may be made. Alas! a stringent economy must prevent any amelioration in the condition of the labourer, and the want of that amelioration may result in labour disputes. There are breakers ahead, but the little island will not founder upon them. The Barbadians are an energetic race. They will not yield without a struggle. Hitherto they have done much for the soil, neglecting the crushing power of the mills. Attending to both, they deserve, and let us hope they will secure, success. I fear in the colony of Demarara, and probably in Trinidad, there has been more anxiety to have good machinery than to gather from the soil the largest amount of produce. The estates generally are well provided with machinery. They have the triple effet and centrifugal machines. The plants generally would do credit to a British refiner. With such appliances it is a shame for anyone to declare before a magistrate in England, that the West Indian sugars are unfit for use unless they are refined in England. It is worse than a shame; it is a crime, and one that must be committed, I fear, knowing it to be a crime. "Thou shalt not bear false witness against thy neighbour."

Yours, &c.,

W. H. JONES.

2, Vermont Road, Upper Norwood,
21st June, 1890.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

6484. G. Fletcher, London. *Improvements in evaporating pans.* 28th April, 1890.

6813. C. W. Guy, London. *Improvements in and relating to crushing mills.* 2nd May, 1890.

7006. O. Pimienta, London. *Improvements in sugar packing machines.* 6th May, 1890.

7407. F. A. Huntington, London. *Improvements in crushing mills.* Complete specification. 13th May, 1890.

7772. E. Martin, Watford, Herts. *Improvements in filtering machinery.* 19th May, 1890.

7773. E. Martin, Watford, Herts. *Improvements in apparatus connected with filtering machinery.* 19th May, 1890.

8092. J. N. S. Williams, London. *Improvements in sugar cane slicing machines.* Complete specification. 23rd May, 1890.

8676. W. Barford & J. E. S. Perkins, Peterborough. *Improvements in grinding and crushing mills.* 5th June, 1890.

8994. Herbert J. Haddan, London. (Communicated by G. H. Hazelton, U.S.) *Improvements in vessels for measuring sugar, etc.* 10th June, 1890.

9045. C. U. Fisher, London. (Communicated by A. Leblane, Cuba.) *New and useful improvements in sugar cane mills.* 11th June, 1890.

ABRIDGMENTS.

1247. Andrew Fairgrieve, of 40, Marchmont Crescent, Edinburgh, Sugar Merchant. *Improvements in the manufacture of raw or refined sugar and apparatus to be used therein.* January 23rd, 1890. The liquor is treated in vacuum till the saturation point is reached, when the vacuum is allowed to subside, the pan being as full as possible. Drying apparatus is illustrated in the drawings.

2870. W. P. Thompson, F.C.S., M.I.M.E., of the Agency for Foreign Patent Solicitors, 6, Lord Street, Liverpool, and at Manchester and London. (A communication from Robert Maurin, of

Donaldsonville, Parish of Ascension, State of Louisiana, U.S.A., sugar planter.) *For improvements in and appertaining to apparatus for cutting sugar canes and other like plant stems.* February 22nd, 1890. A series of vertical cutters and a flat triangular cutter are mounted upon a frame somewhat similar to a plough. This is driven through the standing canes and cuts them down in its passage.

AMERICAN.

ABRIDGMENTS.

426139. C. C. Peck, of New York. *Apparatus for distilling and concentrating liquids.* April 22nd, 1890. This invention consists in substituting for the ordinary vacuum pan an apparatus consisting of a metal or other tank provided with a heating coil, in which tank a vacuum cyclinder is placed vertically, and in connecting a number of tanks so that the heat travels throughout the series. Also in connection with the discharge pipe of the heating coil providing means for automatically discharging the condensed liquor and heating the feed liquid.

426140. C. C. Peck, of New York. *Evaporating apparatus.* April 22nd, 1890. This apparatus is intended chiefly for use in the evaporation of brine.

427107. O. Pimienta, of Cardenas, Cuba. *Sugar packing machine.* May 6th, 1890. The cubed sugar is packed in half a box and the other half is afterwards placed in position.

427108. O. Pimienta, of Cardenas, Cuba. *Sugar packing machine.* May 6th, 1890. According to this invention, a table is provided with suitable apertures and means for raising or lowering a casing of the size of the interior of the box intended to contain the sugar. The pieces are arranged in layers in the casing which is then placed in the box, and on being withdrawn leaves the sugar in place.

428217. S. M. Lillie, of Philadelphia, assignor to the Sugar Apparatus Manufacturing Co., of the same place. *Process of and apparatus for using heat in sugar refineries.* May 20th, 1890. This inventor utilizes what has heretofore been waste steam from boilers, etcetera, in sugar refineries, to heat water for refining purposes, to heat the bone black revivifiers and for similar uses.

428281. A. Miller, of New York, assignor of one half to R. Deeley, of same place. *Evaporating Apparatus.* This invention relates chiefly to the location and arrangement of the heating belts or

pipes in vacuum or other pans and also to the circulating devices used in connection therewith.

428439. A. J. Adamson, of Sabetha, Kansas. *Apparatus for roasting and treating sorghum and sugar cane.* May 20th, 1890. The pieces of cane are placed on an endless conveyor and passed through an oven or heated tube. The object of this treatment is to destroy grubs or animalculae.

BELGIUM.

ABRIDGMENTS.

75840. Pfeifer & Langen, Brussels. *Improved process for the application of lead, either as oxide or as electrode, to saccharine matter.* 5th January, 1887. The object of the invention is the application of lead, either in the form of oxide or as electrode, for precipitating foreign matters, especially the "raffinose" contained in sugar solutions.

75990. T. Kane, Saint-Josse-ten-Noode. *Improvements in sugar candy and in the method of manufacturing the same.* 18th January, 1887. The inventor claims: 1. The improved process of making sugar candy, which consists in boiling a mixture of cane or beet sugar and glucose in a vacuum until it acquires the required consistency. 2. The improved process of making sugar candy, which consists in boiling cane sugar and glucose in a vacuum until they acquire the consistency of "cassé" or sticks of candy. 3. As a new product, candy obtained by boiling cane sugar and glucose in a vacuum.

76042. C. Rudolph & Co. & R. Farkac, Brussels. *An improved process for refining raw sugar juice.* 22nd January, 1887. This invention has for its object the refining of raw sugar juice based on the specific weights of its component parts, by means of a centrifugal apparatus with unperforated drum.

76137. L. A. Boucheron, Brussels. *Improvements in filtering sheets for sugar centrifugals.* 29th January, 1887. The inventor claims: In centrifugals for sugar works and refineries, the use and manufacture of filtering sheets of copper and of brass made by perforating the metal with rows of very small slits from 1/10th of a millimetre to 1 millimetre in size, bell-mouthed on one side and provided, between these rows on the side of the bell-mouth of the holes, with ribs or partitions, which, when placed on the partitions of the drum of the centrifugal, form channels through which the juice can flow, thus avoiding the necessity for a double sheet.

76228. Boucheron & Deny, Brussels. *Improvements in the construction of centrifugals for sugar works and refineries.* 4th February,

1887. The invention consists in the use, in the centrifugals of sugar works and refineries, of filtering sheets of copper or other metal, formed by perforating the metal with tools having conical holes, or in the shape of a staircase, for which Belgian patents have been granted to M. G. Fontaine, Nos. 52975, 53157, and 53371. These holes are arranged either directly one above the other or obliquely, which arrangement gives greater strength to the solid parts.

76241. P. Laberie, Brussels. *Improvements in evaporating apparatus for beetroot, sugar cane, and other saccharine juices.* 5th February, 1887. The inventor claims a rapid and economical evaporation of the juices of sugar canes, beetroot, and other juices or liquids to be concentrated, by the arrangement, in a vacuum apparatus, of a pipe conveying warm air to the liquid to be evaporated, which air, set in motion by the action of an aspirator communicating with the elbow-pipe, raises, agitates, and aerates the liquid through which it passes, and draws away with it the vapours formed by the said liquid.

76248. J. B. Demoutier, Maubray. *Improvements in apparatus for purifying the residual water of sugar refineries.* 5th February, 1887. The water left after the diffusion process, and especially that from the exhausted slices or water from "Kluseman" presses is infectious and impure, because it carries along with it organic and fermentable matter. This water is consequently very injurious from a hygienic point of view. In the sugar refinery of Belœil (Hainaut) the inventor has used an arrangement of apparatus with basins for decantation and purification, to avoid this inconvenience, in which impure water from sugar works is treated and rendered harmless.

76591 T. Lamal, Brussels. *Improvements in the application of electricity to the fermentations of saccharine liquids intended for the distillery.* 5th March, 1887. In vats of any size and capacity, and beneath and above the liquid the inventor places two electrodes, the one of zinc and the other of copper, forming the positive and negative poles and receiving the electric current which is proportioned to the capacity and density of the liquid to be fermented.

76624. N. Ruggeri, Saint-Josse-ten-Noode. *Improvements in lime-kilns applicable to sugar refineries.* 9th March, 1887. The inventor claims:—1. Calcining lime by the heat developed by three furnaces which surround the calcining chamber. 2. Separation of the furnaces vertically by pilasters, the products of combustion passing through the interior of the furnace between the same. 3. The

introduction of air by a regulator fixed to the doors of the cinerary and furnaces. 4. The injection of vapours under the furnace grates, and to the interior of the furnace on the layers of limestone by means of a small boiler and a suitable arrangement of pipes. 5. Heating the water in the boiler by the radiation of the furnaces.

GERMAN.

ABRIDGMENTS.

49422. R. Nithack, Nordhawsen. *Improved automatic continuous-acting extraction apparatus.* 27th September, 1888. In this extraction apparatus, which in construction resembles the conical screw presses, a paddle shaft is used to press the juice from the beetroot shreddings, the juice running out at the side of the top of the apparatus, the shreddings which have been pressed together are loosened by the backward movement of the paddle shaft, while simultaneously by means of pumps which are at this point of the process set in motion, water is discharged amongst the loosened cuttings, and finally the lixiviated cuttings removed from the apparatus. The principal part of the apparatus consists of a conical vessel assuming at its under part a cylindrical form with double sides in which the above mentioned paddle shaft rotates. Two of these vessels can be fixed one on top of the other. The bevelled wheel driving gear used for setting the paddle shaft in motion is so transposed by pushing aside the gear shaft, that an annular sector shaped projection of a gear wheel presses against a cam in the gear spindle, pushing it in one direction, while a counterweight or the like draws it back as soon as this action ceases. At the same time a coupling in the eccentric for driving the pump is automatically thrown in and out of gear by means of a second annular sector-shaped projection on the gear wheel, which comes into action by means of a rod and counterweight fixed on the adjustable lever of the movable coupling box.

49931. Middleton Crawford, New York, U.S.A. *Press with cylindrical pressing surfaces placed eccentrically to one another.* 8th December, 1888. A cylinder provided internally with steam heating space is mounted eccentrically within an outer cylinder, their relative positions being governed and adjusted by means of guide rods and adjusting screws. The machine is set in action by a shaft actuated by suitable gearing, the motion being imparted to the outer cylinder by means of a spur wheel which engages a circular rack fixed upon

the outer cylinder. The material under treatment is fed into the space between the two cylinders, and the juice which is extracted by means of the press passes through perforations in both, and from thence into a discharge pipe. The material from which the juice has been extracted is detached by scrapers, and cut into cakes by a knife which is reciprocated by means of a beaked cam actuated by the driving shaft.

50033. T. Bögel, Brieg, Reg. Bez. Breslau. *Process for producing dry or nearly dry masse cuite.* 9th April, 1889. As much raw sugar is stirred into the granular masse cuite, either in the ordinary vacuum apparatus at from 100 to 110 degrees Centrigade, that on cooling a solid dried mass is produced, or the syrup is separated from the masse cuite in the well known manner by centrifugalling. The mass is again boiled down in a vacuum apparatus and again added in a vessel provided with rotary stirrers to the raw sugar from which it was separated before, whereupon the mass stiffens into an almost completely dry crystalline condition. It is then pulverised and washed out with alcohol, and almost all the sugar contained is obtained in a pure state.

50062. Julius Schwager, Berlin. *A counter-condenser.* 20th October, 1888. The cold liquid enters by a pipe into the condenser and forms a water lock at its underneath part. The gases to be cooled are admitted through an opening into the condenser. An air-pump which is in connection with two pipes, catches the cold liquid from the underneath part of the condenser, and the cooled gases from the upper part.

50067. Rudolph Bergreen, Roitzsch, Bitterfeld. *Root-shredder provided with massive triangular prongs.* 15th March, 1889. The root-shredder is formed of a smooth steel plate, the upper part of which consists of massive triangular cutting surfaces, so that with the co-operation of the straight knife cutter, even triangular shreddings are produced.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO MAY 31ST.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Germany	2,904,619	3,054,124	2,362,351	1,799,460
Holland	205,096	198,327	157,583	110,518
Belgium	431,879	439,396	287,075	232,146
France	88,510	777,246	73,403	478,725
British West Indies & Guiana	10,34,264	630,158	939,544	476,952
British East Indies	347,354	86,171	224,228	41,873
China and Hong Kong	....	....	....	....
Mauritius	116,504	36,802	119,521	24,394
Spanish West India Islands	46,000	....	41,890	....
Brazil	655,493	173,301	461,405	104,634
Java	702,211	557,165	675,218	425,955
Philippine Islands	159,905	46,569	98,414	23,269
Peru	238,765	297,045	187,138	200,074
Other Countries	368,672	137,567	299,236	97,090
Total of Raw Sugars	7,299,672	6,433,871	5,927,006	4,015,090
Molasses	169,136	207,643	61,625	69,975
Total Sugar and Molasses	....	....	9,675,026	7,443,152
Refined Sugars.				
Germany	2,073,177	2,127,564	2,022,468	1,728,493
Holland	596,258	732,803	2,022,468	609,923
Belgium	117,719	66,219	585,070	60,128
France	603,984	1,158,920	118,767	640,602
United States	8,324	21,328	601,749	18,384
Other Countries	397,050	718	*350,932	557
Total of Refined	3,796,512	4,107,552	3,686,395	3,358,087

EXPORTS.—Refined Sugars.

	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Sweden and Norway	31,806	25,621	24,971	18,372
Denmark	49,932	50,363	38,352	30,633
Holland	36,310	36,268	26,825	25,574
Belgium	11,764	11,675	8,222	7,963
France	4,489	4,099	3,306	2,651
Portugal, Azores, & Madeira	24,067	42,559	17,437	27,974
Italy	34,862	39,524	27,761	26,423
Other Countries	57,732	96,005	48,271	72,475
Total of Exports	250,962	306,114	195,145	212,065

* Included with other articles prior to 1890.

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of May, 1890, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1887, 1888, and 1889, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				May.	May.	May.	Monthly Average.				May.	May.	May.	Monthly Average.				May.	May.	May.
	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France	1363	1686	1888	3428	1778	2263	3577	5099	4855	3398	8161	2202	6789	8808	6462	6541	5286	11589	3980	9052	12385
Holland	3780	3267	3005	3149	3518	2785	4081	2483	2675	3074	4179	1995	2710	4693	6263	5942	6079	7328	5513	5495	8774
Germany & Austria	1347	1510	2964	2849	1541	3352	3029	10463	11729	17245	18427	16351	19466	24146	11810	13239	20209	21276	17892	22818	27175
Belgium	592	622	995	449	517	598	343	308	227	267	213	161	237	220	900	849	1262	662	678	835	563
United States	454	8	..	45	23	..	137	2804	157	98	168	727	24	737	3258	165	98	213	750	24	874
Russia	3	..	..	..	..	..	..	452	1959	4275	..	418	2002	..	455	1959	4275	..	418	2002	..
Other Countries	..	1	14	..	..	..	..	15	2	10	7	..	688	31	15	3	24	7	..	688	31
Total	7539	7094	8866	9920	7377	8998	11167	21624	21604	28367	31155	21854	31916	38635	29163	28698	37233	41075	29231	40914	49802

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

TO JUNE 21ST, 1890 AND 1889. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

	STOCKS.		DELIVERIES.		IMPORTS.	
	1890.	1889.	1890.	1889.	1890.	1889.
London	33 ..	45	128 ..	146	113 ..	159
Liverpool ..	64 ..	54	135 ..	148	115 ..	108
Clyde......	46 ..	47	110 ..	118	115 ..	145
Bristol	2 ..	3	36 ..	32	34 ..	29
Total ..	145	149	409	444	377	441
	Decrease..	4	Decrease..	35	Decrease ..	64

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Circular.)

FOR THE FOUR PRINCIPAL PORTS. IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND. FOR MAY, 1890 AND 1889.

	STOCKS. May 1st.		DELIVERIES. In April.		IMPORTS. In April.	
	1890.	1889.	1890.	1889.	1890.	1889.
New York	28 ..	20	72 ..	90	87 ..	77
Boston	3 ..	1	16 ..	18	18 ..	27
Philadelphia....	2 ..	3	32 ..	24	33 ..	20
Baltimore	.. ..	..	.. ..	..	.. ..	..
Total......	33	24	120	132	138	124
	Increase..	9	Decrease..	12	Increase ..	14
Total for the year			555 —	374	576 —	481

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, June 19th, 1890.

FAIR REFINING.	96o/o CENTFS.	GRANULATED.	STAND. A.	STOCK IN FOUR PORTS.
June 19, 1890.—4 13-16c.	5 7-16c.	$6\frac{5}{8}$c.	$6\frac{3}{8}$c..	Jan. 1, 1890— 11,169 tons.
June 20, 1889.—7c.	8c.	$9\frac{1}{8}$c.	$8\frac{7}{8}$c.	Jan. 1, 1889— 32,254 tons.
June 21, 1888.—$4\frac{3}{4}$c.	5 9-16c.	$6\frac{3}{4}$c.	$6\frac{1}{4}$c.	Jan. 1, 1888— 47,798 tons.
June 23, 1887.—4 7-16c.	5 3-16c.	5 15-16c.	$5\frac{1}{2}$c.	Jan. 1, 1887—102,279 tons.
June 24, 1886.—4 13-16c.	5 7-16c.	6 3-16c.	$5\frac{3}{4}$c.	Jan. 1, 1886— 57,328 tons.
June 25, 1885.—$5\frac{5}{8}$c.	$6\frac{1}{4}$c.	$6\frac{3}{4}$c.	$5\frac{5}{8}$c.	Jan. 1, 1885— 89,186 tons.
June 19, 1884.—$4\frac{7}{8}$c.	5 11-16c.	$6\frac{1}{4}$c.	$6\frac{3}{8}$c.	Jan. 1, 1884— 60,900 tons.
June 20, 1883.—$6\frac{1}{4}$c.	$7\frac{5}{8}$c.	8 13-16c.	$8\frac{1}{4}$c.	Jan. 1, 1883— 50,297 tons.
June 22, 1882.—$7\frac{1}{4}$c.	8 1-16c.	9 7-16-$\frac{1}{2}$c.	$8\frac{7}{8}$c.	Jan. 1, 1882— 43,927 tons.
June 23, 1881.—$7\frac{7}{8}$c.	$8\frac{5}{8}$c.	$10\frac{3}{8}$-$\frac{1}{2}$c.	$9\frac{3}{4}$c.	Jan. 1, 1881— 66,999 tons.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 31ST MAY, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	German Empire.	Austria.	Remaining four principal *entrepôts*.	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
138	195	39	220	142	27	761	512	685

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST MAY, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	France.	Holland	German Empire.	Austria.	Remaining four principal *entrepôts*.	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
292	492	45	431	272	367	2899	2827	2666

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1889-90.	1888-89.	1887-88.	1886-87.
	Tons.	Tons.	Tons.	Tons.
German Empire ..	1,260,000 ..	990,604 ..	959,166 ..	1,012,968
France..........	800,000 ..	466,767 ..	392,824 ..	485,739
Austria-Hungary..	750,000 ..	523,242 ..	428,616 ..	523,059
Russia..........	470,000 ..	526,387 ..	441,342 ..	487,460
Belgium	210,000 ..	145,804 ..	140,742 ..	135,755
Holland	60,000 ..	46,040 ..	39,280 ..	36,098
Other Countries..	80,000 ..	87,000 ..	79,980 ..	69,127
Total....	3,630,000	2,785,844	2,481,950	2,750,206

Mr. Licht has, as might be expected, made no change in his figures, which are as given last month. But he has, as we suppose he is bound to do, commenced to give some vague estimates of the probable quantity of the next beet crop, based on the acreage of this year's sowings, which we cannot but regard as premature.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

A somewhat similar state of inactivity and slow sale to that reported last month has again characterised the cane sugar market during June. Prices have varied but little, and may be quoted as practically unchanged. A further weakness is again apparent in refined sorts, which are somewhat lower. In beet there has been a decidedly quiet business, holders being firm, and prices, which at one time were a little higher, close at last month's figures. Refiners are cautious in operating, being undoubtedly deterred by the smaller margin of possible profit, owing, it is thought, to the competition of foreign refined sugars. And it would seem as though the large excess of the production of last campaign, and the expectation of a possible large beet crop this year would now prevent any rise in prices, whether from speculation or otherwise. Prices for autumn delivery closed decidedly weaker.

Changes in stocks, as compared with last year, are:—London, 12,000 tons less; Liverpool, 10,000 tons more; Clyde and Bristol about the same as at this time in 1889.

The relative position of the imports remains unchanged, being, as last month, 64,000 tons below the total quantity imported up to the same time in 1889.

Present quotations for the standard qualities, as under, are:—

Floating.			Last Month.
Porto Rico, fair to good Refining	12/9 to 13/9	against	12/9 to 13/9.
Cuba Centrifugals, 97°/₀ polarization	14/3	,,	14/3 to 14/6.
Cuba, fair to good Refining	12/9 to 13/3	,,	13/- to 13/6.
Java, No. 14 to 15 D.S.	14/6 to 14/9	,,	14/6 to 15/-.
British West India, fair brown	12/-	,,	12/-
Bahia, low to middling brown	10/3 to 11/-	,,	10/3 to 11/-.
,, Nos. 8 to 9	11/6 to 12/3	,,	11/9 to 12/3.
Pernams, regular to superior Americans	11/- to 12/9	,,	11/- to 12/9.
Landed.			**Last Month.**
Madras Cane Jaggery	9/9 to 10/-	against	9/9 to 10/-.
Manila Cebu and Ilo Ilo	9/9	,,	9/6 to 9/9.

Paris Loaves, f.o.b.	15/6 to 15/9	against	16/-
Russian Crystals, No. 3, c.i.f.	No business.		
Titlers	18/-	,,	18/-
Tate's Cubes	19/-	,,	19/6
Beetroot, German and Austrian, 88%, f.o.b.	12/3	,,	12/3

THE

SUGAR CANE.

No. 253. AUGUST 1, 1890. Vol. XXII.

☞ The writers alone are responsible for their statements.

CHANGE OF ADDRESS.

All communications to be addressed to "The Editor of the Sugar Cane, Manchester."

For Table of Contents, see page i.

A number of Members of Parliament, representing agricultural districts, met on the 12th June at the Westminster Palace Hotel, to hear a paper read by Dr. Gustaf Schack-Sommer on "Home Grown Sugar, a Remedy for Agricultural Depression." The paper was to a certain extent a re-statement of the facts dealt with in a paper with a similar title read before the Liverpool Society of Chemical Industry, and as we have already reproduced a large portion of this paper in *The Sugar Cane* for April (pp. 189 to 196), we abstain from quoting any part owing to the limited space at our disposal this month. A certain amount of interesting discussion took place, the almost unanimous opinion being that it is perfectly possible to grow sugar beets as a paying crop. The opinion, however, seemed to be equally unanimous that so long as the system of bounties is in operation on the continent the possibility of producing beet sugar in England *to pay* would be, to say the least, doubtful. We would call attention to the instructive paper by Mr. George Stade, of Berlin, as well as the circular of the well-known fruit preservers, Messrs. Keiller & Co., both of which will be found further on.

The progress which is being made with the very promising question of raising canes from seed is being steadily investigated. What is being done in Demerara in that direction is detailed in the very interesting "Report on the Botanic Gardens and their Work in 1889," from which we extract particulars, to be found on pages 417 to 420. Professor Harrison, as will be known to many of our readers,

is now at work in Demerara, and will no doubt pursue the investigation with the ardour and ability which characterises his work. We understand that Professor Harrison is not quite satisfied with certain statements respecting the original discovery of the possibility of growing canes from seed, which appeared some months ago in the public press. Without expressing any opinion on the matter, we may as well remind our readers of the old maxim, *audi alteram partem.* Men who have attained to eminence in any particular branch or pursuit are naturally and very pardonably susceptible on any points affecting their speciality.

According to the *Demerara Argosy*, the always important subject of labour supply is now demanding public attention more loudly than ever, owing to the goldfields attracting so many hands. *The Argosy* seems to think that the gap may be filled up from Barbadoes where the season is drawing to a close. St. Vincent and Jamaica are also hinted at as possible sources of supply, as the labourers employed on the Panama Canal have returned home. But the question of labour is an equally troublesome one in Jamaica, where the legislature some time ago submitted to the Colonial Office a scheme for the immigration of coolies, which has only been partially approved by Lord Knutsford. The *Colonial Standard* very pertinently remarks "we do not see why the principle and practice allowed in British Guiana and Trinidad should not be permitted in Jamaica."

The Governor of Jamaica is interesting himself very energetically in the forthcoming Exhibition, having visited in person all various districts of the island, to stir up a proper feeling on the point.

From Natal we hear of the project of a Colonial Exhibition for 1892 or 1893 being vigorously advocated.

We give this month a short statement of sugar imports into the Cape, to which are appended some remarks on the position of the Cape with regard to Natal and the Mauritius, extracted from the *Journal des Fabricants de Sucre.*

From Cuba we hear that on some of the estates, where *improved machinery* has reduced the cost of production, grinding, which was

generally interrupted by the late rains, has been able to be resumed. One of the principal of these is the "Constancia" at Cienfuegos, belonging to Apezteguia Hermanos, which has already produced this season over 18,000 tons of first and second sugar. In this district are situated twelve of the largest plantations in Cuba, of which the "Constancia" is the largest, and their total production amounts to nearly 130,000 hogsheads. The alterations likely to be made in the McKinley bill are not expected to affect the import of Cuban sugars.

We are rather curious to hear more of the electric process of Messrs. Maigrot & Sabates, respecting which the *Havana Weekly Report* some weeks ago stated that they had seen a sample of sugar purporting to have been manufactured by that process, which was of great purity of colour, and polarised 100°.

Messrs. Willett & Gray inform us that the recent decision in regard to the Trust forfeits the charter, but not the property of the North River Sugar Refining Company, and say that the decision seems to simplify the position of the Sugar Trust, the future course of action of which is perfectly clear; and if they accept the position, as they are suppose to intend doing, their securities will appreciate in public estimation.

From the *Philadelphia Evening Bulletin* we learn that in the important patent case in the United States Court, Judge Butler has decided that Lillie's patent for sugar evaporation apparatus is valid, and that the Yaryan patent apparatus used by Harrison & Company is an infringement upon it. In this case both parties agreed not to use experts, the counsel themselves acting as experts, and the suit involves all the sugar manufacturers in the country and a large amount of money.

On the Continent the proposed alterations in sugar legislation are exciting no small amount of attention. The probable course of action on the part of the Governments of France, Belgium, Holland, and also Germany is practically an indication that they are determined to have a larger share of the excessive profits resulting the manufacturers and refiners from the bounty systems. In France, as will be known to our readers, the proposition of the Government is to tax the

refiners, who have hitherto escaped equivalent taxation, and to raise the duty on the *excédants* of the manufacturers by 10 francs. At the beginning of the month it was decided to adjourn the discussion until after the holidays, but we now learn that the Budget Commission have succeeded in getting this decision reversed. The discussion is proceeding, the first article raising the duty on *excédants* from 20 francs to 30 francs per 100 kilos. of refined sugar has been passed by the Chamber. As there are some 80 amendments to the Government's scheme, the final decision can hardly be reached this month (July).

We are compelled by want of space to omit our usual statements respecting German and Austrian sugar factories and refineries.

The announcement is made that the *Deutsche Zuckerindustrie*, so ably conducted for many years by the late M. Wilhelm Herbertz, has passed into the possession of a Company, under the management of Messrs. Carl Hager and Robert Hennig, both well known to those interested in sugar matters in Germany. We heartily wish this valuable publication all the success it undoubtedly merits, and which it has already enjoyed for a number of years.

The *Deutsche Zuckerindustrie*, the *Berliner Politische Nachrichten*, and the *Berliner Tageblatt* are engaged in a lively discussion from different points of view of the probable course to be adopted by the Government. Our space will not allow of any reproduction of the very interesting correspondence, but we think the remarks of Herr Von Maltzahn, which will be found on page 407, are worthy of attention, and are somewhat ominous for those whose interests are involved in the maintenance of the present state of sugar legislation. No better proof of the financial unsoundness of bounties on production or export could be given than the fact that all the Continental Governments interested in sugar, except perhaps Austria, are, to use the very words of the manufacturers, "harassing" them by constant changes in the laws under which they have reached their inflated production and gained their unjust profits—unjust to the nation which has to pay to keep them in prosperity.

Mr. Licht, in his Monthly Report for July, takes exception to our remarks in last month's issue respecting his statements as to prospects

of the coming beet crop. By a reference to another page, which should have appeared at the end of our remarks, the latter were made to apply equally to the extract from the *Berliner Tageblatt*, which we printed in the same number. Unfortunately this reference was omitted at the last moment by the printer, on his own responsibility, as he could not make out to which page it referred. Mr. Licht has thus just cause to complain of our inconsistency and partiality. But Mr. Licht complains further of our having treated his remarks as "estimates." We are totally unable to see what is the use and purpose of the figures given in the June Monthly Report, if they are not to form a basis for an "estimate" as to the probable crop of the coming campaign, and, as a matter of fact, although Mr. Licht guards himself against being supposed to give an "estimate," he proceeds to make a *computation*, which in effect is an estimate. What we wished to warn our readers against was the unwisdom of allowing their judgment to be influenced for the present by any forecast respecting a crop which is still exposed to so many vicissitudes, a proceeding which reminds us of the proverbial allusion to "counting chickens before they are hatched."

COST OF PRODUCTION OF BEET SUGAR WITHOUT BOUNTIES.

With Notes on the Working of a Beet Sugar Factory.

By Geo. Stade (of Geo. Stade & Co.), Charlottenburg 2, (Berlin).

With regard to the movement in certain agricultural circles in England (see Dr. Schack-Sommer's paper, "Home-grown Sugar"), as well as in the United States of North America (Claus Spreckel's agitation in California—the building of the new works of the Oxnard Beet Sugar Company, Nebraska), and various attempts in Canada, Australia, Japan, etc., it may perhaps not be without interest to the readers of *The Sugar Cane* to have some authentic figures with regard to the working of an average sized factory in Europe. Of course, I

do not pretend to supply anything particularly new to those acquainted with the European sugar industry.

The details given below are taken from the annual (July) business report of a sugar works of twenty-five years' standing, and are kindly placed at my disposal.

The beets (for the most part grown in five rows) are forwarded to the works by road, and delivered free at the store-rooms. The land is level, and the soil well suited for beet culture.

The hydraulic elevator, now in use in nearly all modern factories in Europe, conveys the roots at once to the washing machines, from which there is a sufficient fall to carry the water off to the irrigated meadows. From the washing machines the beets, after being weighed, are elevated to the slicing apparatus. The exhausted and pressed slices are at once removed from the place.

The diffusion juice is clarified with lime,

First carbonatation with 2 % CaO.
Second carbonatation with 0·5 % CaO.

and afterwards saturated with sulphurous acid (SO_2) to reduce the alkaline reaction. Four "monstre" filter presses (of 750 square feet filtering surface each), take up the scum of the first clarification. Small presses are used for the second and third clarifying operations and for filtering the syrup (concentrated juice), no bone black at all being used for purifying purposes. The evaporation takes place in a quadruple effet, and the filtered syrup is boiled down to masse cuite in the pans. First centrifugal sugar (96° to 97° pol.) is sold to the refiners in the district, being of very fine quality; second and third qualities (93° to 89° pol.) are exported.

A and B.—*Agriculture and Transport of Beets.*

Acres in cultivation .... 1777 (= 711 hectare).
Yield per acre .... 14 tons (= 35 tons per hectare).

Nearly the whole of the area in cultivation belongs to the proprietors of the sugar works.

The cost of production (inclusive of carriage to the works), is given as follows :—

TABLE I.

Cost of Agriculture and Carriage of the Beets.

	Cost per Acre.				Cost per Ton of Beet.			Cost per Cwt. of Beet.		Cost per Ton of Sugar.			
	\$	£	s.	d.	\$	s.	d.	s.	d.	\$	£	s.	d.
Total..	53·70	11	4	0	3·84	16	0	0	9½	29·84	6	4	4

1 acre land yields = 1·8 ton of sugar (I., II., and III.).

C.—*Manufacture.*

Average work per day .. .. 350 tons beet.
Working days for the crop .. .. 74½.
Beet worked per crop .. .. 25,095 tons.
Average percentage of saccharose ($C_{12}H_{22}O_{11}$) in the beet.. .. .. 13·92 %

Yield.

Masse-cuite I.: 3,866·5 tons = 15·40 % of the beet.

I. Sugar	2752·5 tons	= 10·97 %	of the beet.
II. Sugar..	281·4 tons	= 1·12 %	,,
III. Sugar	168·0 tons	= 0·67 %	,,
Total Sugar (I., II., and III.) ..	3201·9 tons	= 12·76 %	beet.

100 tons masse-cuite I. gave—	Of 100 tons sugar (I., II., & III.)—
71·2 tons I. sugar	86·0 tons were I. sugar
7·3 tons II. ,,	8·8 tons were II. ,,
4·3 tons III. ,,	5·2 tons were III. ,,

Total yield of 100 tons I. masse-cuite: 82·2 tons sugar (I., II., & III.)
7·77 tons of beet yield 1 ton of sugar.

I will now proceed to reproduce the working expenses of the factory in a detailed form, leaving out the European duties on beet and sugar, assuming that all the sugar is exported. This manipulation will give a pretty clear idea respecting the much spoken of necessity of a "premium" for the beet industry. Of course it may be said that all works are not working as cheaply as the one I am now speaking of. I am well aware of this fact. However, to be just, there are on the other hand many places—and particularly the large new factories—which work a good deal cheaper, in spite of the necessity of writing off large sums from their profits for amortisation.

TABLE II.

Calculation of Expenses in the Manufacturing Department.

	Expenditure (in Dollars and Shillings).						
	Per Acre.		Per Ton of Beets.		Per Cwt. of Beets.	Per Ton of Sugar.	
	$	s.	$	s.	s.	$	s.
1. Management	2·70	11·25	0·19	0·80	0·040	1·50	6·25
2. Wages	4·57	19·05	0·32	1·35	0·067	2·53	10·58
3. Carriage	0·80	2·94	0·05	0·21	0·010	0·39	1·63
4. Materials	4·57	19·05	0·32	1·35	0·067	2·54	10·61
5. Fuel	7·27	30·32	0·52	2·15	0·105	4·04	16·83
6. Maintenance	10·45	43·59	0·84	3·09	0·154	5·79	24·16
7. Freight of Sugar	4·56	18·02	0·31	1·28	0·064	2·40	10·00
8. Commission	4·65	19·38	0·33	1·37	0·068	2·58	10·75

TABLE III.

General Expenditure for Agricultural Operations, Conveyance of Beet and Sugar Works.

	General Cost (in Dollars and Shillings).						
	Per Acre.		Per Ton of Beet.		Per Cwt. of Beet.	Per Ton of Sugar.	
	$	s.	$	s.	s.	$	s.
A and B. Agriculture and Conveyance of Beet	53·70	224·00	3·84	16·00	0·80	29·84	124·30
C. Sugar Works	39·25	163·69	2·78	11·59	0·58	21·79	90·85
Cost of Production	92·05	387·69	6·62	27·59	1·38	51·63	215·15
Deduct Molasses	4·63	19·31	0·33	1·36	0·07	2·52	10·71
Net Expenditure of the Sugar Manufacture	88·32	368·38	6·29	26·23	1·31	49·11	204·44

Some remarks may be added. (1) No extraction of the molasses is practised in the sugar works in question, and (2) the price of molasses is also put down as "bounty free." (3) The shareholders of the company invested a capital of about \$100,000 = £21,000 in the enterprise. During the first few years the works (started with such a small working capital), were not very successful, but later on the return was by no means a bad one, as may be seen from the small table (IV.) annexed. The gross profits (including amortisation fund and manager's percentage) from 1864 to 1890 are given as follows—taking as basis the price of \$4·80 = 20s. for one ton (= 2204 lbs. = 1000 kgs.) of duty-paying beets.

TABLE IV.

Gross Profit of the Sugar Works from 1864 to 1890.

Crop.	\$.	£.
1864–65	— 1,770	— 370
1865–66	— 4,650	— 970
1866–67	— 15,250	— 3,180
1867–68	+ 7,050	+ 1,470
1868–69	+ 18,590	+ 3,880
1869–70	+ 9,090	+ 1,890
1870–71	+ 36,150	+ 7,540
1871–72	+ 18,000	+ 3,750
1872–73	+ 33,730	+ 7,030
1873–74	+ 28,030	+ 5,850
1874–75	+ 52,030	+ 10,850
1875–76	+ 49,110	+ 10,240
1876–77	+ 26,670	+ 5,560
1877–78	+ 63,710	+ 13,230
1878–79	+ 32,550	+ 6,790
1879–80	+ 84,340	+ 17,580
1880–81	+ 43,520	+ 9,070
1881–82	+ 93,310	+ 19,450
1882–83	+ 111,250	+ 23,200
1883–84	+ 58,530	+ 12,200
1884–85	— 1,180	— 490
1885–86	+ 21,600	+ 3,500
1886–87	+ 19,500	+ 4,070
1887–88	+ 48,720	+ 10,160
1888–89	+ 38,180	+ 7,960
1889–90	+ 38,420	+ 8,020

For crop 1887 there was a change in the management, and since then the following amounts (of which the greater part is already written off), have been invested in real improvements and absolutely necessary alterations:—

Crop 1887-88—about \$21,000 = £4500....In new and improved machinery and general building alterations.

Crop 1888-89—about \$20,000 = £4000 ...In re-building the evaporation station with quadruple-effet, &c.

Crop 1889-90—about \$20,000 = £4000....In alteration of the clarification and filter-press arrangements, &c.

Crop 1890-91—estimated at \$25,000 = £5000....In slicing machine, evaporation with multiple-effet, boilers, patent vacuum pans, &c.

For the next crop (1890-91) the factory should be prepared to work up to 500 tons of beet per day, that is to say, the whole work of the campaign will be done in 50 to 60 days, with a consumption of fuel guaranteed not to exceed 7 to 8 tons per 100 tons of beets = 10 to 12 cwt. per ton of sugar (that means 10s. to 12s. per ton of sugar, I., II., and III., taking the price of fuel at about £1 per ton).

By this change it will be possible considerably to reduce the cost of production, so as to be able to subsist with or without the "Government bounty."

I prefer not to draw any conclusion or moral application from my statistics; I will only say that the European sugar manufacturer is wide awake and hard at work—rationally and intelligently,—and sum up with the old proverb: "*Verbum sapienti satis.*"

CIRCULAR ADDRESSED TO THE FRUIT-GROWERS OF THE UNITED KINGDOM.

By Messrs. James Keiller and Co., of Dundee.

Gentlmen,—As amongst the largest fruit preservers in the United Kingdom, we tkink it advisable to draw your attention to the very serious consequences arising from the violent fluctuations of the sugar market. We need not point out that, in this matter, our interest is identical with yours, and that it is of essential importance to us that the price of sugar should be both low and steady.

A large amount of ignorance and misconception prevails with regard to the cause of these fluctuations; and as, from our position

in and close contact with the leading sugar markets of the kingdom, we have exceptional opportunities of ascertaining the truth, it will, we are sure, be useful to lay before you the facts.

You are, no doubt, aware that this country is becoming more and more dependent for its supply upon Continental beetroot sugar, the enormous development in which is due to the artificial stimulus given by the payment of bounties on exportation from the countries where it is grown. There can be no doubt that if that system progresses as it has done in recent years, beetroot sugar will almost entirely supplant cane sugar in this country. The following figures will enable you to form a judgment upon this point:—

Imported United Kingdom.	Beetroot. Per cent.	Cane. Per cent.
1876	31	69
1886	52	48
1889	65	35
1890 (first 5 months)	81	19

With reference to these figures, we may mention in the first place, as a matter of considerable importance, that in certain branches of British manufacture beetroot sugar is found unsuitable, and a guarantee on purchasing sugar is extensively required that it is made purely from cane.

Probably, however, the question which commands the largest share of interest is the effect which the abolition or maintenance of the bounties would have upon prices. This is a point which requires very close and unprejudiced study, and as we are looking at it only in its relation to our industry, we put entirely on one side its political and economic bearings, which have been producive of much hot controversial warfare; indeed, so much party spirit and rancour have been introduced, as to obscure the real issues to such an extent that it has become extremely difficult for any, except unprejudiced experts, to get at the true merits of the case. As such unprejudiced experts, we beg to offer ourselves to the fruit-growers and the public generally. We do so with considerable confidence, inasmuch as it is universally recognised that we can have only one object in view, viz., the obtaining of ample and steady supplies at the lowest possible price.

Does the bounty system, then, beget low prices? The first impulse is to reply that of course it must. Are not the bounties a gift from foreign governments to lower the price of sugar to us? This, no

doubt, is the popular and superficial view which largely prevails. But great as may be the folly of these governments in this matter, it is not quite so egregious as that. The case is better stated thus—That bounties are given to artificially support an industry which otherwise *is unable to compete with the corresponding industries of countries* favoured with greater natural advantages, and so make competition possible which, without them, would be impossible. In other words, bounties are a device for handicapping nature. Thus a bounty might be so adjusted as to bring about merely a transfer of the locality of an industry, without affecting the price of the commodity one way or another to the consumer, only that the price, in a place where the article can be produced naturally at that price, is much more reliable, and more likely to be permanent, than where it can be produced only by artificial stimulus. Therefore, it is the interest of the consumer to encourage the locality of natural production rather than the locality of artificial production. This is more especially the case when the artifice in question is subject to the ever changing whim and caprice of foreign and even unfriendly governments. Of course, so far as we are concerned, so long as the price remained the same, the question would not interest us directly, although it would be unwise altogether of us to ignore the fact that, the more our home and colonial industries prosper, the greater the prosperity of our own is likely to be.

But everyone must be aware that bounties have effected changes in price, and the question arises—Have we hitherto had our sugar *cheaper or dearer in consequence? The fact is, very violent* fluctuations have taken place, and sometimes it has been cheaper than it otherwise would have been, and sometimes much dearer. In which direction the final balance has lain cannot, perhaps, be proved; but our opinion is that even in the past we certainly have not gained anything, and that the fruit preserving industry owes nothing to the sugar bounties for its great development.

With reference to the more important question of the future, we have no hesitation in giving it as our clear conviction, that the abolition of bounties will secure us cheap sugar, and that their retention will make it dearer.

In adducing our reason for this strong opinion, it is necessary to put before you the cause of the periodical excessive cheapness in the past, to which we have alluded. There is only one cause which can

bring prices below cost price, and that is over-production. The commencement of new and extensive competition entails the selling by the rivals at below cost price. That was the case in the years when the bounty-fed beet sugar was selling at prices which proved ruinous even to many who received the bounty. But the effect upon beetroot sugar producers was insignificant compared with the effect upon the cane sugar planters. Numbers of plantations were put out of cultivation and their owners irretrievably ruined. Of much more serious importance, as far as we are concerned, is the fact that a general and deep-seated distrust took hold of the survivors, from which they have never recovered; and although, as we are assured on the most trustworthy authority, it is a matter of fact that, at the average price of the last three years, cane sugar plantations would have paid very handsomely indeed, yet a gradual retirement from the contest is taking place.

We desire to convey to you the expression of our conviction that the disastrous rise in price last year had not, in any degree, for its cause, either the Sugar Convention itself or the Bill introduced into Parliament by Baron Henry de Worms. That rise is really only an illustration of what we believe we shall be perpetually liable to, as long as the bounty system continues. We would therefore, in conclusion, venture very strongly to urge you to bring your powerful influence to bear upon those who represent you in the House of Commons, in order to encourage them to support the Government in its determination to fulfil the obligation they have come under of ratifying the Sugar Bounties Convention.

We ask you to do this solely on the ground of thereby advancing your own interests, by securing for the future a permanent supply of suitable sugar for your and our purposes, at low and steady prices.

James Keiller & Son.

We entirely concur with the above views,

Batger & Co., London.
W. H. Flett, Limited, Liverpool.
S. Whittaker & Son, Salford and Burnley.

July, 1890.

THE SUGAR BOUNTIES IN GERMANY.

The Secretary to the Imperial Treasury, Herr von Maltzahn, lately alluded to the London Convention, in connection with the sugar duties in Germany, in the following terms:—

"I may tell you openly that in speaking of the State revenues which could be reckoned on during the next few sessions, I was thinking primarily of the sugar duties. But you all know how matters stand in this respect. The Imperial Government, by taking part in the negotiations which preceded and followed the London Convention, and by provisionally agreeing to the Convention itself, clearly declared its opinion that the abolition of the sugar bounties was in itself a desirable end. The term fixed on for the ratification of this convention is as yet not expired, and I think it would be unfair both to the remaining participators in the Convention and to the industry which would eventually be affected by the regulations in question, if we were to proceed to make any alteration in this direction before the expiration of the term.

Even if it should be desired to obtain a larger revenue from sugar, the form which the legislation will assume will be materially affected by the conclusion which the first of August will bring us."

RAFFINOSE, MELITOSE, OR MELITRIOSE.*

By ARTHUR R. LING, F.I.C.

In view of the discussion now going on amongst technical chemists in the sugar industry as to the presence of raffinose† in certain commercial beet-root sugars, notably those recovered from low syrups, I have been induced to compile the following *resume* of the chemical work which has been done on this compound, there being, so far as I am aware, no such account in English chemical literature at the present time.

The fact that raffinose possesses a high dextro-rotatory power renders its detection and estimation in commercial sugars a matter of

* An abstract of this paper was read at the Conference of Chemists held at the Beetroot Sugar Association's Rooms on June 26, 1890, to consider the methods for the detection and estimation of raffinose.

† Throughout this paper I have made use of the name raffinose, since, although the objection that it is based on the misconception that the compound is formed during a process of refining from cane-sugar has been urged against it by several eminent German chemists, it is more generally known in England by this name.

a priori importance, since the percentage of cane-sugar in the same is invariably determined by the optical test.

The history of the compound commences in the year 1842, when Johnston (*Mem. Chem. Soc.*, i., 159) separated a sugar from a species of eucalyptus indigenous to Tasmania. He ascribed to it the formula $C_{12}H_{28}O_{14}$, and showed that it contained water of crystallisation. It was next examined by Berthelot in 1856 (*Annales chim.* [3], xlvi., 66), who gave it the name melitose, and found that it had a specific rotatory power $[\alpha]j$=88, that it was converted by the action of dilute acids into a mixture of a fermentable sugar—probably glucose—and a non-fermentable sugar, eucalyn.

Ritthausen, in 1884 (*Jour. Pr. Chem* [2], xxix., 351), and Böhm (*Ibid.*, xxx., 37) obtained a sugar from cotton seed, which the former regarded as identical with Berthelot's melitose, whilst the latter considered it a distict substance, and called it gossypose.

In the year 1876 Loiseau (*compt. rend.*, lxxxii., 1058) separated a crystalline sugar from the beet-root molasses of Messrs. Sommier et Cie. which had the composition $C_{18}H_{32}O_{16}$,$5H_2O$, and possessed a relative rotation to that of cane-sugar, 159: 100; this he called raffinose. Tollens (*Ber.* xviii., 26) expressed the view that raffinose was identical with the sugar from cotton-seed, and probably also with Berthelot's melitose, but he confirmed Loiseau's number for the rotatory power. This was finally established by Scheibler (*Ber.*, xviii., 1779) and by Rischbiet and Tollens (*Ibid.*, 2611; *Annalen*, ccxxxii., 169).

O'Sullivan has separated raffinose from barley (*Chem. Soc. Jour. Trans.*, 1886, 70), and v. Lippmann (*Ber.*, xviii., 3087; xxi. *Ref.*, 889) has demonstrated its presence in beet-roots themselves.

In his first experiments Tollens (*loc. cit.*) favoured the formula $C_{12}H_{22}O_{11}$,$3H_2O$ of Berthelot, Ritthausen, and Böhm, inasmuch as he found that raffinose lost about 13 p.c. of water at 100°, and that decomposition begins above this temperature, but it was subsequently shown by Scheibler (*loc. cit.*) that when the compound is dried, first in a partial vacuum over concentrated sulphuric acid for about a fortnight, and then at 100° a loss of about 15 p.c. of water is attained, which corresponds to that demanded by Loiseau's formula, $C_{18}H_{32}O_{16}$,$5H_2O$. Rischbiet and Tollens then showed that the amount of mucic acid obtained on oxidising raffinose with nitric acid was, assuming that the compound yields a third of its weight of

galactose, consistent with Loiseau's formula, but from a consideration of the sodium derivative, which they found contained 6-7 p.c. of sodium, they were led to double this formula. The determinations of the molecular weight made since by Tollens and Mayer (*Ber.*, xxi., 1566) and by Brown and Morris (*Chem. Soc. Jour. Trans.*, 1888, 619), who employed Raoult's freezing-point method, as well as that of de Vries (*Compt. rend.*, cvi., 751), who determined the isotonic coefficient, point, however, to the simpler formula.

In molasses rich in raffinose the latter separates out on standing, whilst from such as contains less Scheibler's method (*Ber.*, xviii., 1409) may be employed for its isolation. This consists in converting the mixed sugars into the mono-strontia compounds and cooling, when about 75 p. c. of the sugar-cane separates out as mono-strontia saccharate; the filtrate is boiled with an excess of strontium hydroxide, and the precipitate containing the distrontia compounds of raffinose and cane-sugar decomposed by a current of carbonic anhydride. The process is then repeated, a syrup being ultimately obtained consisting chiefly of raffinose, the compound being finally purified by crystallisation from alcohol.

Raffinose crystallises in needles or prisms which are almost insoluble in absolute alcohol but very easily soluble in water. Its specific rotatory power is, according to Landolt (*Ber.*, xxi., 198), $[\alpha]_D = 104{\cdot}5$, which represents the mean of the values obtained by Scheibler, Tollens, Rischbiet and Tollens, v. Lippmann, Loiseau, and Ritthausen. Beythien and Tollens have more recently given the value $[\alpha]_D = 104{\cdot}4$ (*Annalen*, cclv., 195).

It has been shown by Rischbiet and Tollens (*Annalen*, ccxxxii., 110) that when raffinose is warmed on the water-bath with dilute acids under fixed conditions, the specific rotatory power is reduced to about one half,* but that if more concentrated acid be employed and the heating continued for a longer time the reduction in rotation reaches one fifth, with the formation of a certain amount of humus matter (*cf.* Scheibler and Mittelmeiér, *Ber.*, xxii., 1684). This has been confirmed by numerous observers. Rischbiet and Tollens (*Ber.*, xviii., 2611) have shown further that when raffinose is heated for a considerable time with acids, levulinic acid is produced, and have

* Scheibler and Mittelmeier (*Ber.*, xxii., 3120) state that a dilute solution of the invertase of yeast has an action at the ordinary temperature similar to that of dilute acids at a higher temperature, whilst a strong solution of 40° determines the complete inversion.

confirmed Berthelot's statement that mucic acid is formed when raffinose is oxidised with nitric acid, the amount obtained under the conditions given being 22—23 per cent. of the weight of raffinose.* Raffinose does not reduce Fehling's solution until after heating with acids, and, like cane-sugar, it is stable in alkaline solution. It possesses only a very faint sweet taste. Rischbiet and Tollens (*Annalen*, ccxxxii., 110) have found that raffinose is completely fermentable with yeast. Berthelot (*Compt. rend.*, cix., 548) finds, however, that an active yeast completely ferments it, but a weak yeast only about one-third, whilst Loiseau (*Compt. rend.*, cix., 614) states that fermentation is complete with a low fermentation yeast, but only reaches one-third with a high one. There appears to be no sharp qualitative test for the recognition of raffinose.

The fact that raffinose yields compounds with bases has long been known, and has been specially studied by Scheibler and by Beythien and Tollens (*Ber.*, xxii., 1047; *Annalen*, cclv., 195). Di-strontia raffinose,—

$$C_{18}H_{32}O_{16},2SrO,H_2O,$$

baryta raffinose, $C_{18}H_{32}O_{16}BaO$, di-baryta raffinose, $C_{18}H_{32}O_{16},2BuO$, lime raffinose, $C_{18}H_{32}O_{16},3CaO,2H2O$, are known and are obtained by treating raffinose with the respective oxides. A lead oxide compound,—

$$C_{18}H_{32}O_{16},3PbO,$$

obtained by adding ammoniacal leads acetate to an aqueous solution of raffinose, and the sodium derivatives, $C_{18}H_{31}O_{16}Na$ and $C_{18}H_{31}O_{16}Na,NaOh$, also exist (*cf*, also Rischbiet and Tollens, *Annalen*, ccxxxii., 182).

Since raffinose possesses the formula $C_{18}H_{32}O_{16}5H_2O$ it might be conjectured that it was built up of three *hexoseglucose* residues, just as cane-sugar, maltose, milk-sugar, &c., are built of two, and if this were so it would be, adopting Scheibler's nomenclature (*Ber.*, xix., 2870), a triose. Hence the name melitriose. It has already been stated that when raffinose is warmed with dilute acids the rotatory power is reduced to about one-half; now Rischbiet and Tollens have found that alcohol extracts a glucose from this inversion syrup, having about the optical rotation of levulose; this observation has been confirmed by Scheibler and Mittelmeier (*Ber.*, xxii., 1678), who

* Assuming that galactose forms a third part of the total inversion product, since this sugar yields about 75 p. c. of mucic acid on oxidation with nitric acid, the amount obtainable from raffinose should be 22·7 p. c. (Rischbiet and Tollens, *loc. cit.*).

adduced further evidence that it was levulose by showing that it yielded Emil Fischer's phenylglucosazone on treatment with phenylhydrazine acetate. The last-mentioned chemists have also shown, by means of the phenylhydrazine reaction, that the accompanying product contained in the inversion syrup is a sugar having the composition $C_{12}H_{22}O_{11}$,* which they have named melibiose; it follows, therefore, that when raffinose is warmed with dilute acid it is hydrolysed in accordance with the following equation:—

$$C_{18}H_{32}O_{16}+H_2O=\underbrace{C_{12}H_{22}O_{11}}_{\text{Meliboise.}}+\underbrace{C_6H_{12}O_6}_{\text{Levulose.}}$$

In considering the secondary inversion of raffinose, *i.e.*, when it is heated with more concentrated acid, the fact that it yields mucic acid when heated with nitric acid gave at once a clue that one of the inversion products was galactose; Rishbiet and Tollens have indeed isolated this sugar from the secondary inversion product of raffinose, and the discovery of Ganz and Tollens (*Chem. Zeit.* xi., 772, 1171) that saccharic acid is also one of the products of the action of nitric acid on raffinose renders it extremely probable that the latter is derived from dextrose, and that this sugar also forms one of the products of the hydrolysis of raffinose, the more so as a search for other glucoses, *e.g.*, mannose, with phenylhydrazine has led to negative results (*cf.* Beythien and Tollens, *Annalen*, cclv., 214). If, therefore, the above is correct, melibiose must, like milk-sugar, be made up of a dextrose and a galactose residue. The complete inversion of raffinose will, therefore, take place in accordance with the equation:—

$$C_{18}H_{32}O_{16}+2H_2O=\underbrace{C_6H_{12}O_6}_{\text{Levulose.}}+\underbrace{C_6H_{12}O_6}_{\text{Dextrose.}}+\underbrace{C_6H_{12}O_6}_{\text{Galactose.}}$$

In order to prove that when raffinose is completely inverted only simple glucoses are present Scheibler and Mittelmeier have shown (*Ber.*, xxii., 1684) that the mixed osazones obtained from such a solution are insoluble in water, a property which, according to Emil Fischer, is characteristic of the osazones of glucoses; and to lend further support to the view that the inversion product is in reality a mixture of levulose, dextrose, and galactose, which would yield, on conversion into osazone, two-thirds of glucosazone and one of galactosazone, the mixed osazones were compared with a mixture of the pure substances in these proportions, and found to possess the same melting point, 200—201°.

* The elementary analysis of this compound has been published within the last few weeks (Scheibler and Mittelmeier, *Ber.*, xxiii., 1488).

It will now be necessary to consider the nature of melibiose, which may be prepared from raffinose either by the action yeast,—the invertase of which partially inverts the raffinose, the levulose formed being subsequently destroyed by fermentation,—or by that of dilute sulphuric acid, in which case the levulose is extracted by alcohol. Melibiose is not only isomeric with milk-sugar, but appears to be derived from the same proximate constituents, *e.g.*, dextrose and galactose. That it is not identical with milk-sugar is shown by the high rotation of partially inverted raffinose (near 50, or about the rotatory power of milk-sugar itself), which is known to contain a third of its weight of (left-handed) levulose. Scheibler and Mittelmeier find (*Ber.*, xxii., 1681) that melibiosazone has the same composition, $C_{24}H_{32}N_4O_9$, as that which Fischer has assigned to lactoseazone, but that the two compounds differ slightly in properties, and they have further characterised melibiose (*Ber.*, xxiii., 1440) by its specific rotatory power, $[\alpha]_D=127$ (approx.), by its hydrazone, $C_{18}H_{28}O_{10}N$, melting at 145°, and by its octacetyl derivative, which crystallises in needles melting at 170—171°. The latter has a bitter taste, and possesses a specific rotation in a mixture of two parts of alcohol and one of cloroform, $[\alpha]_D=94{\cdot}2$; it reduces Fehling's solution on warming, but does not react with phenylhydrazine. Octacetyl-lactose melts at 86°.

It has been already rendered probable that melibiose contains an aldehyd group by the fact that it reacts with phenylhydrazine, and Schiebler and Mittelmeier have strengthened this hypothesis in a most ingenious manner (*Ber.*, xxii., 3122). They have shown that when a solution of melibiose is reduced by sodium amalgam, being kept neutral by the addition of dilute sulphuric acid from time to time, the resulting solution does not reduce Fehling's solution until it has been boiled with dilute sulphuric acid. The aldehyd group of the meliboise, therefore, probably undergoes reduction to an alcohol group :—

$$\underbrace{C_{11}H_{21}O_{10}{\cdot}C{:}OH+H_2}_{\text{Melibiose.}} \quad = \quad \underbrace{C_{11}H_{21}O_{10}{\cdot}CH_2OH}_{\text{(? Melibiotitol.)}}$$

a compound melibiotitol* being formed which undergoes hydrolysis with acids into galactose and mannitol.

$$\underbrace{C_{12}H_{24}O_{11}+H_2O}_{\text{(? Melibiotitol).}} \quad = \quad \underbrace{C_6H_{12}O_6}_{\text{Galactose.}} \quad + \quad \underbrace{C_6H_{14}O_6}_{\text{(? Mannitol).}}$$

* The existence of this compound is simply inferred ; it was not isolated.

The solution containing the inverted substance gives with phenylhydrazine—phenylgalactosazone; the presence of galactose is therefore demonstrated.

Going back to raffinose, it appears highly probable that this compound does not contain a free aldehyd group, but that melibiose, which differs from it by the splitting off of a levulose residue, does; also that this aldehyd is reduced to an alcohol group on treatment with sodium amalgam. Scheibler and Mittelmeier assume that since melibiose is composed of a dextrose and a galactose residue, it is the former which carries the aldehyd group, inasmuch as when the hypothetical alcohol, melibiotitol, again undergoes hydrolysis, galactose is the glucose obtainable.

If this be so, the following will represent the order of the different residues in the molecule of raffinose.

Ri	Rii	Riii
Levulose residue.	Dextrose residue.	Galactose residue.

Now, although this conclusion is based on altogether too slender evidence to be considered final, it certainly explains what is known of the behaviour of raffinose in a satisfactory manner; *e.g.*, the degree of firmness with which Ri and Rii are held together in the raffinose molecule corresponds exactly to that with which the levulose and dextrose residues are held together in the cane-sugar molecule, and further that of Rii and Riii to that of the dextrose and galactose residues in the milk-sugar molecule.

Emil Fischer has proposed the following constitutional formula for milk sugar:—

$$\underbrace{CH_2OH(CHOH)_4CH\left\langle\begin{matrix}O\cdot CH_2\\ O\cdot\end{matrix}\right.}_{\text{Gelactose residue.*}}\underbrace{\vphantom{O}\!CH(CHOH)_2CHOH\cdot COH.}_{\text{Dextrose residue.}}$$

Scheibler and Mittelmeier consider this to be the most probable formula for melibiose also, but that the difference between the latter and milk sugar lies in the difference of the combination of the carbinol groups of the dextrose with the aldehyd group of the gelactose.

Scheibler and Mittelmeier have found (*Ber.*, xxiii., 1441) that raffinose forms an undecacetyl derivative, $C_{18}H_{21}O_5(OC_2H_3O)_{11}$, which is easily soluble in hot alcohol, and is precipitated on cooling as an amorphous powder. It melts at 99—100°, has a bitter taste, does not reduce Fehling's solution, and possesses a specific rotation at

17° in 8 per cent. alcoholic solution $[\alpha]_D = 92{\cdot}2$. The existence of this compound indicates that raffinose contains eleven hydroxyl groups, and the presence of a larger number is not conceivable.—*Chemical News.*

As a sequel to the above paper we append a translation of the method of determining the amount of raffinose as used in Germany and also almost universally in Austria-Hungary. The subject has lately had special attention at the General Meeting of the Association of German Beet Sugar Manufacturers, held at Leipzig on the 29th of May last.

Extract from the Official Instructions Published in connection with the German Sugar Duties Act.

of July 9th, 1887, taken from the Yellow Book for 1888, page 861.

"When the chemist is required to take into account the presence of raffinose, the following method is to be adopted:—

(1) The polarisation of the sugar is ascertained in the usual way.

(2) The polarisation is ascertained after inversion at exactly 20° C.

Inversion is effected in the following manner, the usual precautions being taken: One-half the normal weight (13·024 grms.) of sugar is dissolved in 75 cc. of water; 5 cc. of hydrochloric acid (38·8%) are gradually added, and the mixture heated in a water bath to from 67 to 70° C. The temperature of the mixture must be maintained at this point for five minutes, the flask being frequently shaken. The whole operation lasts from 7½ to 10 minutes. After cooling to 20° C., water is added, the mixture well shaken and polarised directly after filtration or after treatment with animal charcoal. The observations have to be made in glass tubes surrounded by water for cooling at exactly 20° C.

To calculate the result the following two formulas are used:—

$$\text{S (Sugar)} = \frac{0{\cdot}5188\text{P-I}}{0{\cdot}845}$$

$$\text{R (Raffinose)} = \frac{\text{P-S}}{1{\cdot}85}$$

P stands for direct polarisation and I for polarisation after inversion of the whole normal weight.

Though this method is undoubtedly very exact, yet considering its novelty a tolerable wide margin has to be allowed for experimental

errors. This margin is consequently taken at 0·6% deviation from the saccharine content, as calculated according to the raffinose formula, compared with the results obtained by direct polarisation. If, for instance, the polarisation of the sugar be 92·6, and if by the raffinose formula only 92% be obtained, the difference must be considered as an experimental error, and in such a case raffinose must be assumed to be absent, and the saccharine content taken as obtained by direct polarisation. If however, 91·9% of sugar are found by the raffinose formula against 92·6% by direct polarisation, the presence of raffinose cannot be doubted. To prevent mistakes, an analysis must be made according to a method to be described hereafter. As the amount of raffinose, when present at all in sugars of high percentage, has always, so far as has been observed, been more than the above margin of 0·6%, this method will be applicable even though so wide a margin for error has to be allowed. Quantities of raffinose less than 0·6% cannot be estimated by any of the known methods, and therefore cannot at present be taken into consideration. Scheibler's method is also not to be relied on for detecting such small quantities of raffinose. This method is however very useful in many cases as a check to ascertain whether raffinose really is present, when according to the inversion method only small differences (as for instance less than 1%) from the direct polarisation are obtained.

For this purpose the polarisation, water, and ash of the sugar are ascertained; the organic non-sugar is put as equal to the salts, and the sum of polarisation, water, ash, and organic non-sugar is, in every case where raffinose is present, above 100. If it be under 100, the sugar is to be considered as free from raffinose. In the former case the amount of raffinose is calculated in the following manner:—The percentage of water, plus double the amount of the ash, is deducted from 100, the difference indicates the amount of sugar plus anhydrous raffinose. If we call the figure thus obtained a, the polarisation p, the sugar x, and the raffinose y, we arrive at the following equation:—

$$x + 1\cdot85\, y = p$$

$$x + y = a$$

$$x \text{ (amount of sugar)} = \frac{1\cdot85\, a - p}{0\cdot85}$$

$$y \text{ (amount of raffinose)} = a - \frac{1\cdot85\, a - p}{0\cdot85}$$

The margin for experimental error is to be taken as 0·3%, *i.e.*, the sum

of polarisation of double the ash and water must be more than 100·3 when this method is applied.

The following instance is taken so as to show that differences of 0·6% of sugar cannot be estimated by this method if the above margin for error be taken.

A sugar gives 99·7 polarisation, 0·4 of water, 0·1 of ash; the sum of all the components is

$$\begin{array}{r} p = 99{\cdot}7 \\ +\ 0{\cdot}4 \\ + 2 \times 0{\cdot}1 = 0{\cdot}2 \\ \hline 100{\cdot}3 \end{array}$$

consequently

$$\begin{array}{rl} a = & 100{\cdot}0 \\ - & 0{\cdot}4 \\ - & 0{\cdot}2 \\ \hline a = & 99{\cdot}4 \end{array} \qquad p = 99{\cdot}7$$

Consequently x (sugar) = 99·05, and y = 0·3. The 0·3% over polarisation, obtained by the calculation method, and which has to be taken as the margin for experimental errors, corresponds with the like variation in polarisation and actual sugar content which has been fixed for the inversion method with the raffinose formula as the margin for experimental error.

If by the latter method 1% or less of sugar is found than by polarisation, the analysis by the calculation method is not necessary, and even in case of a negative result from the latter, the result of the raffinose method is to be taken as final. In such case, however, this is to be stated. Should the calculation method leave it doubtful whether or not raffinose be present, or if the presence of raffinose has been proved with certainty, the result of the calculation method is not to be stated in the certificate, but only that of the inversion method, using the raffinose formula, if the difference of the amount of sugar found by the latter be more than 0·6% as found by polarisation. If the difference be 0·6% or less, it is to be stated that raffinose is not present. In making the calculation hundredths are to be stated in round figures—thus, in place of 97·01 of sugar, 97·1 is to be stated in the certificate."

SEEDLING CANES IN DEMERARA.

We have received the "Report of the Botanic Gardens and their work" at Georgetown for the year 1890, from which we have pleasure in extracting the following particulars. The Report is drawn up and signed by Mr. G. S. Jenman, the Government Botanist and Superintendent of the Gardens.

Cane Seeding.

Every morning for the three months following the middle of August, my time was spent in the cane field, taking observations on the subject of the sugar cane seeding. This question having been settled a year before, and the seminal fertility of the cane established on an irrefragable basis in Barbados, I was anxious to gather all that could be learnt by observation and experiment here. The first arrows appeared in the plots of Kara-ka-ra-wa and Brekeret, in the third week in August; a fortnight later in Striped Singapore and Seete, and some plants of Caledonian Queen that were 17 months old followed. Six weeks later the majority were in flower, though the different varieties showed considerable variation of both time and character in performing this function. Mani, Samuri, Lakona, Lahaina, Vico, Drard, and Sacuri did not show flower till the first week in November, at which time the following kinds exhibited no indications of flowering at all—Elephant, a dark purple variety unnamed, Honolulu, Selangore, White Mauritius, Chyaca, China I, China II, Ko-poa-pa, Bamboo II, Chigaca, and large Green. Nearly all this latter lot failed to flower at all, and those that did, China I, Selangore, and White Mauritius, only bore an odd arrow here and there. The arrows of the different varieties vary greatly in size and in form and density. In some they are not over a foot long, in others they are three feet; some have relatively few branches and flowers; others relatively many. As regards shape: in some the lower branches are longest, thus making as they spread at right angles or slightly droop, a perfect pyramid; in others the lower branches are the shorter. In all cases where the arrow is fully extruded the

branches spread at a wide angle, and in some quite horizontally or drooping. In several varieties, however, the arrow is arrested in the sheath and never gets more than half way out. The light-coloured varieties have light stamens and the dark ones purple. The stigmas are magenta-coloured in all. The arrows that are well extruded from the sheath and held aloft on a long haft take longest before they break up. Those that are arrested begin to break up immediately after they first appear, and this applies to all the varieties in which arrest of the arrow occurs, a character that is only casual in some varieties, but general in others. The duration of the arrows in the different kinds, in which they are well extruded, varies greatly. In some they last for six or eight weeks, while those of the other extreme last only one or two weeks. It is the same in regard to the time occupied in the disruption of the arrow after this has once begun; in some it breaks up slowly; in others so rapidly that it is almost impossible to get a ripe one containing branches or seed.

Panicles of all the different varieties that flowered were gathered as soon as they ripened for seed, and of most an early and later sowing was made.

The seed required shelter when sown, and having no suitable accommodation, I had shelves put along the side of a shed, just within the eaves, to hold the boxes. This proved unsuitable, for the wind drove the rain in heavily, by which much damage was done to the contents of the boxes. The seed does not separate from the glumes, and is so minute when removed therefrom as to be barely discernible by the naked sight. Apparently, too, not more than one spikelet among hundreds is fertile, and as the fertile and barren differ externally in no particular it is absolutely impossible to separate one from the other, or the seed from the glumes or spikelets. Consequently all the material that can be rubbed off a panicle has to be sown, and to ensure its containing any seeds at all, so few are they to the bulk, a rather matted mass of the spikelets has to be used. This is so loose when dry that the mistake was made of covering it sufficiently with soil to press it down. It requires hardly any covering, for the growing seedlings are so delicate that if covered they cannot penetrate through the surface. Apparently in consequence of this the majority of the varieties produced no plants. After the seeds sprout many of the plants perish. However, about half-a-

dozen of the kinds germinated, from which probably about a hundred plants were grown for a time many of which however perished subsequently. As the parentage in every case is carefully recorded, any variation from the parental types in the seedlings will be easily detected and traced. The seed takes four or five days to germinate, and must be sown freshly gathered, for the vitality is very fugacious. For the first three months the young plants grow exceedingly slowly, but after they have attained a height of two or three inches they progress at an increasingly rapid rate, and are large enough to plant out in the ground in five or six months.

In April Mr. Bovell sent me a seedling from Dodd's Botanical Station, which at the time was about three inches high. Is is now one of the most robust cane plants I have ever seen, about 12 feet high, with from 2–2½ dozen canes and shoots to it, which are 6–8 inches in circumference. The variety is distinct from any I have known. Again in December Mr. Bovill sent twelve canes of six of the best varieties of the set raised at Dodds in 1888. All these are likewise distinct from any of the kinds here in cultivation. Mr. Harrison also gave me a few pieces of three or four other kinds raised there the same year. So that in addition to the lot of seedlings raised here last year, the Gardens possess, and have under trial, nearly a dozen different seedling canes raised in Barbados.

The secret of the cane's seminal fertility having been discovered, one of the chief duties of the future will be raising, testing, and selecting new cane stock, with the object of obtaining varieties superior to any now in cultivation. Hitherto the experimental cane work here has been confined to collecting the known varieties from different parts of the world, growing them side by side to determine their cultural character and qualities, and subsequently chemically analysing them to ascertain their qualities for manufacturing purposes. This has been sufficient to enable planters to judge which varieties were worth cultivation commercially and which not. This work has been done hitherto without cost to the colony, for the expense has been defrayed from the votes for the flower garden and nursery,—branches which ill afford any outside tax on their contracted resources. The discovery of the canes seminal fertility, and the prospect of obtaining thereby numberless new varieties to be grown and tested gives however a new aspect and importance to experimental cane cultivation, and a special

vote is necessary to carry on the work with the completeness of detail and on the enlarged scale required. As the individual canes of a variety vary in quality and character in the same plot, the laboratory analysis of single canes is not always an accurate test of the general quality and character of the variety and plot. Consequently it is desirable to have mill power, to grind a bulk sufficiently large to ensure certainty in the results.

KNELLER'S PROCESS FOR PRODUCING MUSCOVADO SUGAR.

(From the *Demerara Argosy.*)

We have received from a correspondent in St. Kitts the following memorandum on the use of Kneller's process in the working of muscovado sugar; and we are informed that Mr. Boon, who is alluded to as the scientific worker of the process, will be ready at any time to give sugar-planters the fullest information regarding its details.

"About forty years ago Kneller proposed to concentrate syrups by forcing cold air through them, and his plan was much improved by Brame Chevalier. The latter provided his vessel with a steam jacket, a coil of piping inside and a set of tubes; through these last, dry air is forced to the bottom of the pan and rising through the body of the liquid carries off a large amount of watery vapour, at the same time keeping the liquid at an extremely low temperature. Sugar made in these pans completely rivalled that of the vacuum pan in every respect." Vide Lock Wagner and Harland's Book, p. 294 of the 1882 edition.

It is probable that the reason why this process was not extensively adopted at the time it was first devised was the great expense involved, for in those days air compressors which could deliver a large volume of air were enormously expensive, and, as every one knows, pans do not give sufficient pressure to force the air more than an inch or two below the surface of a liquid whose specific gravity is much higher than that of water. Some five or six years ago it occurred to Mr. C. H. Boon that the Roots Blower which is not costly, and delivers a large volume of air at fairly high pressure would fulfil all the necessary conditions, and he therefore imported one and forced air through the

syrup in an Aspinal pan. The result was a peculiar looking sugar consisting of medium sized grains clustered round large crystals, some the size of a split pea, which looked very much like sugar candy. The colour was not very good. It tested 95·8° in New York. About 30 tons were made. For a variety of reasons no more sugar was made by this process until last year when Mr. W. R. Boon took it up, and though the process was very imperfectly worked, made some pretty sugar of good colour and large grain testing 93°. He is so satisfied that the gain in the improved quality of the sugar and in other respects is large, that he is fixing up the necessary machinery on one of his estates to take off the whole of the next crop.

As far as can be judged from the imperfect way in which the process has been worked hitherto the conditions essential to its complete success are :—

1. A deeper pan than an ordinary Aspinal; the syrup surface should be at least 2½ or 3 feet above the point at which the air is delivered. This allows the air to be thoroughly mixed with the syrup ; the air should be delivered in the syrup just above the drum by any arrangement of pipes which will ensure a good distribution ;

2. A Roots Blower delivering at least 1000 cubic feet of air per minute which it is estimated will do for an output of about 25 tons of sugar a week under favourable circumstances. The advantages are :—

1. Much more rapid boiling. The gain is about 20 per cent. ;

2. Evaporation is carried on at a lower temperature. The lowest yet attained is 195° F., but with a well arranged apparatus it is expected that 180° or less will be got ;

3. Larger strikes can be made ; an ordinary Aspinal pan from which (without the air) three strikes go to a ton will hold a ton to a strike ;

4. The sugar tests higher by several degrees ;

5. The molasses is less, but how much less has not yet been definitely determined.

The above is a rough outline of the process and its advantages. As for the cost, that would vary according to whether the ordinary Aspinal pan, which gives very fair results, was used or a deeper pan made specially. In any case it is estimated that on an estate turning out say 500 tons of muscovado the increase in the value of one crop would pay for the necessary machinery several times over.

CAPE OF GOOD HOPE.

IMPORTS OF REFINED AND RAW SUGAR.

The following figures represent the quantities of sugar which entered into consumption in the colony during the year 1888, with the quarter from which they were imported:—

	Cwts.
Refined.	
United Kingdom	11,338
United States	4,218
Germany	167
Mauritius	157
Belgium	30
Natal	1
Raw.	
Mauritius	128,331
Natal	85,575
United Kingdom	16,936
Java	1,633
United States	567
Madagascar	254
Philippine Islands	137
Germany	133
Hong Kong	32
Molasses.	
United Kingdom	7
Mauritius	1

No sugar being produced in the colony, it is dependent on Mauritius, Natal, and Great Britain for the greater portion of its raw, and on Great Britain and United States for its refined sugar supply. In the beginning of 1888 a conference, held at Cape Town to consider a proposition for a Customs Union between various South African States and Colonies, had proposed to favour the import of Natal sugars by a differential tariff. It was thought that this would induce Natal to enter into a combination, certain aspects of which were not quite to her mind. In the preliminary scheme a duty of 12/6 per 100 lbs., to be reduced by half for sugar imported from countries belonging to the union, had been voted. This article would have, in effect, consti-

tuted an actual bounty on export granted by one British colony to another; it would have been irreconcilable with the spirit of a project for an International Convention on sugar duties which was at that moment being discussed in London, and the essential aim of which was, as they were reminded by the French delegates, to establish conditions of equality between the signatories, by the suppression of all premiums whether open or disguised. The declarations previously made by Baron de Worms seemed to indicate that the Cape was one of the autonomous colonies, the adhesion of which had been received by the Queen's Government, although this was not positively stated, and in fact, in the final Convention to which France under certain reserves agreed, the powers stipulated on behalf of their possessions beyond sea, leaving to them the faculty of withdrawing separately.

As regards the Cape, that country renounced, for two reasons, the differential taxation which it had just previously been proposing to adopt; on the one hand, Mauritius protested energetically against the injury which was going to be done to her, the probable result of which was that the mother-country used her influence towards obtaining an amendment in agreement with the general sense of the Sugar Convention,—on the other hand Natal, by finally refusing to join the South African Customs Union, nullified the article favouring her sugar production. At the present moment sugar imported into the Cape Colony pays 6/3 per 100 lbs. wherever it may come from. But the Cape is free to modify its tariffs at any time without the authorisation of the central government, and also to renounce on its own part any participation in the International Sugar Convention.

THE SUGAR INDUSTRY IN QUEENSLAND.

REPORT ON THE CENTRAL SYSTEM.

In November last, Messrs. J. Lissner, M.L.A., and P. Mc.Lean, Under Secretary for Agriculture, received instructions to enquire into the working of the Central Sugar Mills at Mackay, and into a series of complaints contained in a petition asking for an enquiry, and signed by J. Antoney, a shareholder in the North Eaton Central Sugar Mill Company. The report of Messrs. Lissner and Mc.Lean, dated 26th February, has just reached us, having been "issued for public information before being laid upon the table of both Houses." It is as follows:—

NORTH EATON CENTRAL SUGAR MILL COMPANY.

* * * * * *

The total amount of money advanced by the Government to the North Eaton Sugar Mill Company, according to statement supplied by the Treasury, is £25,000. No interest has been paid to the Government up to date, and nothing can be paid for this year, as the money that would have been available for this year's interest has been expended in necessary improvements for working the plant, and a further sum of £1,500 will be required to be spent to make the internal arrangements of the mill adequate to the crushing power.

* * * * * *

We consider that, having in view the great economic problem for solution, for which purpose the money was voted by Parliament to erect these mills, the directors have most glaringly violated the fundamental principle thereof, it being a well-known fact that fully one-half of the cane in the above-mentioned estimate was grown and cut by coloured labour. We cannot definitely state what labour was used in cultivating and cutting the cane supplied by Markey, Harrison, and Mc.Callam, the estimate being furnished after the enquiry had closed; but that the cane supplied by the Victoria and Barrie estates was grown by coloured labour was admitted by the directors.

The statement of receipts and expenditure for the half-year ending 31st December, 1888, and 30th June, 1889, affords no information, whatever, as to whether the 1,424 tons of cane mentioned as a trial crushing was a financial success or otherwise; the different items are so mixed up, that it is impossible to define what amounts were actually spent on manufacturing operations.

The directors could give no idea what the result of the crushing which was in operation during the time the enquiry was being held would be, but promised, by the end of January, 1890, to issue a Balance Sheet showing the exact position of the Company, and to provide us with a copy, which has so far not been done.

The directors furnish the following statement as to the cost of production per ton of sugar, but this is only an approximate estimate :—Twelve tons cane, at 14s. 6d., £8 14s.; cost of manufacture, £3 10s.; total, £12 4s. Price of sugar at mill, £14 10s.; net profit, £2 6s.

On being questioned as to the future prospects, the directors stated that they were confident—given a good season next year—they would be able to work the mill to a success with cane grown exclusively by

shareholders, as the area now under cane was between 900 and 1,000 acres. This acreage being scattered over a wide extent of country, and in some cases at a considerable distance from the mill, we feel confident that successful operations cannot be insured unless tramways are laid down.

In October, 1888, the Company applied for a further advance, as a loan, of £10,000 to enable them to lay tramways; they now consider that the necessary length of tramway could be laid down for £4,000.

RACECOURSE CENTRAL SUGAR MILL COMPANY.

* * * * * *

This mill has cost up to date, £19,000. The shareholders are all freeholders, and have executed bills of encumbrance on their properties.

Crushing operations were commenced on the 15th of July, 1889, at which time only 175 acres of cane grown by shareholders was ready for crushing, estimated to yield 1,500 tons of cane, and actually yielded 1,600 tons. The average return was 10½ tons of cane to 1 ton of sugar.

In the memorandum of agreement, signed by the shareholders, the price fixed for cane was 8s. per ton, but at a meeting of shareholders in July, 1889, a resolution was passed to the effect that 2s. 6d. be allowed per ton for cutting and loading, and 1s. per ton per mile cartage, up to four miles an additional 6d. per ton to be allowed. As all the cane grown by the shareholders would not have kept the mill at work for more than three weeks, the directors purchased from Mr. Steedman, of Pleystowe Plantation, 7,700 tons of cane, paying at the rate of 14s. per ton for plant cane and 13s. per ton for ratoon cane, of this quantity, 1,000 tons were ratoon cane. This cane was grown, as the directors put it, under the usual plantation conditions, which simply means grown by coloured labour.

The prospect of working this mill next season with cane grown by the shareholders entirely is but little better than the last season, the area under cane being about 250 acres, estimated to yield 3,750 tons, at an average rate of 15 tons per acre. To the late adverse season and the want of capital, the directors attribute the non-planting of the area agreed on. There are several small settlers growing cane, but no definite idea of the acreage could be supplied—probably another fifty acres.

It will thus be seen that next season's operations will be fruitless in the solution of the problem this mill was supposed to solve.

The directors urge the following two points in favour of the establishment of the central sugar mill system, namely:—

1. It induces small settlers to grow cane with a certainty of getting it crushed, the directors also purchasing firewood from these people, thus providing them with an additional source of income.

2. The establishment of these mills has increased the price per ton of cane to a remunerative degree to the grower, the increase in price being on an average as much as 5s. per ton.

With reference to these two points urged by the directors of the Racecourse Central Mill Company, the first has not been borne out by facts, as the area under cane will not provide sufficient cane to keep the mill at work for more than fifty working days, crushing at the rate of 90 tons a day, and the second is doubtful till the balance sheet is submitted. At the time this enquiry was held crushing operations had been completed and the season's results were: 830 tons sugar manufactured, 40 tons estimated in tanks. The 830 tons were shipped to agents in Brisbane, Sydney, and Melbourne for sale, the average price obtained being £15 per ton. At the commencement of operations, the directors estimated that £3 10s. per ton of sugar would cover the cost of manufacture, but this result remains to be seen. The directors were of opinion that they would be able to pay one year's interest in January, 1890. A mortgage on the land and a bill of sale on the machinery has been duly executed in each case.

With reference to the working of the central sugar mill system at Mackay, we have to call your attention to the fact that, in so far as operations have been carried on up to the date of this enquiry, the intention of the Legislature in voting a sum of £50,000 to establish this system has been to a very great extent departed from.

The chief condition under which the money was advanced by the Government was to prove, if possible, that the sugar industry could be carried on solely by the employment of European labour.

Now, while Clause 9 of the Bill of Encumbrance and Clause 9 of the Memorandum of Agreement which the shareholders signed, distinctly specifies that "he will employ labourers of European ex-extraction and no others in and about the cultivation, cutting, and the carting of the cane," in the Memorandum of Association and Articles of Association this clause is conspicuous by its absence.

The directors, in their eagerness to make the Company a paying concern, have taken advantage of this omission, and have purchased largely and have given high prices for cane grown by coloured labour. We would also draw your attention to the fact that, whereas the Articles of Association in each Company provide for five shareholders representing the Government, there are now only three; one of the original five is dead, and the other has left the district, and no others have yet been appointed in their place.

In conclusion, we would also state, that, in our opinion, the two Companies at Mackay were too hastily formed, and the plant erected before there was sufficient cane grown to justify the erection of such expensive mills.

BENGAL.

IMPORTS AND EXPORTS OF REFINED SUGAR,

For the Official Year 1889-90.

(From the introduction of the Annual Accounts of the Sea Borne Trade and Navigation of the Bengal Presidency and its ports. By the Collector of Sea Customs, Calcutta.)

SUGAR REFINED.

	1885-86.		1886-87.		1887-88.		1888-89.		1889-90.	
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.
To United Kingdom.	2400	22181	23	328	10033	96792	147	2450	43214	578529
,, France	..	....	..	....	....	....	..	....	....	....
,, Italy	..	....	..	....	....	....	..	....	....	....
,, Ceylon	496	6824	93	1416	920	11470	618	8404	1359	21148
,, Other Countries	1333	18390	1083	14530	3756	45628	3029	31484	872	12670
Total	4229	47395	1199	16274	14709	153890	3794	42338	45445	612347

After trifling exports of refined sugar for a number of years, there was a sudden increase during last year, and shipments advanced to about twelve times what they were in 1888-89. The whole of this

increase was due to larger exports to the United Kingdom. There was, during the opening months of the year, a heavy advance in the price of sugar in Europe—owing to the operations of a Syndicate in Germany—and the shipments from Calcutta, nearly the whole of which were made from May to September, were no doubt due to the artificial rise in price on this account. When the syndicate collapsed, which occurred in July, there was a heavy fall in prices, and our exports practically ceased. During the same period there were also large shipments of unrefined sugar to the United Kingdom considerably in advance of those of the previous year, the figures being—

	Cwts.
1888-89	64,905
1889-90	104,165

This sugar was received from the North-Western Provinces. Notwithstanding these increased exports, there were as usual large imports of refined sugar, amounting to 203,963 cwts., and far in excess of the previous year, the figures being for the principal countries:—

	1888-89. Cwt.	1889-90. Cwt.
United Kingdom	113	10,314
Austria	1	1,949
Mauritius	98,446	103,746
Germany	Nil.	29,038
Ceylon	Nil.	19,943
Hong-Kong	9,426	21,346
Straits Settlements	10,175	17,299

These figures show an increase from all the countries that export sugar to Calcutta. More than one-half of these exports were received during the last three months of the (official) year.

Mauritius has again supplied the largest quantity, and this trade has been facilitated by the regular line of steamers which now trades between that island and Calcutta.

The imports of sugar from coast ports were much smaller than in the previous year.

CALUMET FACTORY REPORT, 1889-90.

By Hubert Edson, Chemist.

Through the courtesy of Mr. W. J. Thompson we have received the report of the results and experience obtained during the campaign of 1889–90 at Calumet Factory, Louisiana. We have often had occasion to allude to this large and exceedingly well managed establishment, and are glad once more to find place for its report, from which practical men may draw valuable lessons. Appended to the report are some remarks on "Chemical Sugar House Control, and the Preservation and Analysis of Samples," for which we cannot find room; but those interested in this very important subject, which is now becoming quite a speciality on most large sugar plantations, can probably obtain a copy of the report by early application to Mr. W. J. Thompson, the address "Calumet Factory, Louisiana, U.S.A.," being sufficient.

Since my report of the campaign of 1888-89, four alterations worthy of note have been made in the plant at Calumet.

Immediately in front of the existing five-roller mill was placed a three-roller mill, the rolls of which are four feet three and one-half inches long, and thirty inches in diameter. The journals of its top roll are ten and one-quarter inches long and eleven inches in diameter, and those of the bottom rolls are ten and one-quarter inches long by eight and one-half inches in diameter. This mill is equipped with Rouselot housings, exceedingly heavy wrought-iron and steel turn-plate, and steel pinions and crown-wheels. The driving-shaft is eleven and three-quarter inches in diameter. The rolls were kept very rough, and were intended not only of themselves to give a higher extraction of juice, but also to prepare the cane for better and more uniform work by the five-roller mill. This addition makes in all eight rolls, or two three-roller mills and one of two rolls.

There were also added at the double effect two of Gaunt's helix separators; one for entrapping oils and water from exhaust steam, just before it entered the steam chamber of the first effect, and one on the vapour pipe of the last effect, to stop all globules of syrup which might be entrained by the vapour on their passage to the condenser. This last separator was shown to be necessary by last season's control work, when a considerable amount of sugar was found to be lost at this point.

Two filter presses, each of the same pattern and capacity as the five already in use, gave an increased fitering area of 436 square feet.

The foot valve of the vacuum pan was enlarged, allowing a stiffer boiling of first masse cuite. The rest of the machinery remained the same as last year, and a description of it can be fonnd in bulletin 23, Chemical Division, U.S. Department of Agriculture.

The Cane Crop.

Never since the present proprietor has been in possesssion of the plantation has the yield of cane per acre been so small, nor since the employment of a chemist has the sugar content of the juice been so low. It is an interesting fact, and worthy of note, that, in opposition to this year, in which the poorest tonnage and lowest sugar were secured, the crop of 1883, which gave the highest tonnage on record at Calumet, also gave the largest per cent of sugar ever known to have been present in the juice worked on this plantation.

The poor crop of the present season is attributable to exceedingly unpropitious climatic conditions. Rains early in the season delayed planting until the seed cane had greatly depreciated. This was quickly succeeded by a drouth of eighty-four days, during which many of the young canes perished. This drouth was in turn followed by exceedingly wet weather, which prevented a laying by of the cane until the latter part of August, an operation which should be performed by July 1st.

The Sugarhouse Work.

As has been the custom for five years, the stubble and plant cane were kept separate in all their products, and this was the only division into runs made. No third sugars were boiled.

The inferior quality of the material, the space necessary to store it, the steam used in keeping it warm in the wagons, and the work of purging, would, it was thought, have made the expense greater than the increased value of the product secured.

The mill was started October 31st, and stopped the early morning of November 28th. There were, during this period, twenty-four days in which the mill was run a whole or part of the time. The system of daily reports gave a more thorough knowledge of the capacity of the various portions of the factory than had ever before been possessed. It will also prove of much value in calculating the capacity of the house for working future crops.

The Stubble Run.

There was during this run an inversion of 3,660 pounds of sucrose, or 1·10 per cent. of the sugar extracted. This was, without, doubt due to some minor delays, the greatest of which was shutting down the apparatus for twelve hours, with juice left in several of the clarifiers. On several other occasions, delays occurred which necessitated the holding of juice for some time, and which could not result otherwise than in inversion. There was, besides this inversion, a mechanical loss of 17,803 pounds of sucrose, of which 16,167 pounds were lost at the double effect, 504 pounds in the press-cake, and 1,024 pounds in handling first sugar. This latter loss was in most part from transferring sugar from centrifugals to bins, and from bins to barrels, and seems to be unavoidable. The loss at the double effect will be discussed further on, under the head of Gaunt's Helix Separator.

48,910 pounds of press-cake contained only 504 pounds of sucrose; so lixiviation was carried as far, probably, as it was profitable. Good cake was not, however, made all the time, some of the pressings almost approaching slush. In comparing this with last year's work at the presses, I can attribute it to but one thing, *i. e.*, the lower purity of the present year's juices. The average purity of the juice of 1888–89 was 85·00; of 1889-90, 82·56; and, though the latter were limed quite as high as the former, and no more work required from an individual press than before, the resulting press-cake was not as solid as was desired.

It would seem, then, that the skimmings and settlings of cane juice will filter readily in direct proportion to the purity of the juice from which they are derived.

Taken altogether, this run gave the poorest results of any during my two campaigns' work on this plantation. There was a total loss of 21,463 pounds of sucrose, out of the 332,216 pounds extracted, which amounted to 6·46 per cent. of the material entering the clarifiers.

The delays in manufacturing were none of them very serious, but they were almost continual. They prove most conclusively the necessity for rapid and regular work. There was *no other reason besides these petty annoyances for the poor results of this run*, and Calumet needed no better proof of the correctness of her regular working system than this one irregular run, with its comparatively large losses.

The percentage of marc, or woody fibre, was not high in the stubble cane, though every one connected with the agricultural work had predicted that, on account of the severe drouth during the cultivating season, such would be the case. The results were, however, entirely at variance with this theory; indicating, rather, that the structural tissue grew proportionately only as the rest of the cane, and did not much, if any, exceed the amount present during a wet season. The only way then that the percentage of marc would be become excessive during a dry season would be an entire cessation in the growth of the plant, in which case the water would begin to evaporate and normal conditions cease to exist. Final conclusions, especially in agricultural work, can not be drawn from one season's results; but at Calumet, the cane, after passing through one phenomenal drouth, and not containing an excessive amount of marc, would indicate that dry weather does not materially affect this constituent of the cane.

The masse cuites of this run, both first and second, were boiled very stiff, only 6·33 per cent. of water being left in the first, and 7·29 per cent. in the second.

The final molasses contained 31·75 per cent. of sucrose, double polarization, 25·13 per cent. of glucose, and had a purity of 40·11.

The first product was a high-grade yellow clarified sugar, 98·74 pure. The seconds were an ordinary yellow sugar of 87·51 polarization, and contained 3·32 per cent. of glucose. The yield of firsts was comparatively high, being 77·91 per cent. of the total commercial sugar obtained from the two boilings, and 7·16 per cent. of the weight of the cane worked.

Of 379,236 pounds of sucrose in the cane, 323,114 pounds, or 85·20 per cent. of that present, were extracted. This left 56,122 pounds of sucrose in the bagasse, which was used as fuel. On the stubble cane, then, 14·8 per cent. of the sucrose was grown, not to enter the sugar-house proper at all, but that some very good sugar could be used to make a little very poor fuel.

The Plant Run.

The work during this run was as good as that in the first was poor. There were no delays of any import, and the house was worked to a capacity which before had been thought impossible. There still continued about the same amount of trouble at the filter presses as in the first run, but none serious enough to cause any delay to the rest of the factory. The loss of sucrose was 1,711 pounds in the 112,560

pounds of press-cake made. What little trouble was experienced with the presses only confirmed the opinion previously expressed, that the skimmings and settlings from a low-purity juice filter with more difficulty than those from a juice of high purity.

The loss at the double effect was 9,645 pounds, or 1·01 per cent. of the sucrose extracted, against a loss of 4·87 (?) per cent. in the stubble run. There was no inversion large enough to be detected by the analyses, and the loss, aside from that at the double effect, amounted to but 0·27 per cent. of the sucrose extracted. There was a loss of sucrose in the bagasse of 128,486 pounds, or 12·07 per cent. of the sucrose in the cane. This gives an extraction of 87·93 per cent. of the sucrose in the cane on a mill extraction of 80·23. The marc in the cane was 9·86 per cent. of its weight, which is still further proof that a drouth, in the earlier part of the season, at least, does not tend to produce an excess of insoluble matter in the cane.

The marked difference in the losses of the two runs should be carefully noticed and the cause remembered. Aside from the loss at the double effect, which was excessive in the stubble run on account of a defect in the helix separator, remedied during the plant run, the loss at other points of the house was much greater in the run with stubble cane.

With the stubble, the losses, chemical and mechanical, exclusive of those at the double-effect, were 1·42 per cent. of the sucrose extracted, while in the plant run they were but 0·27 per cent., with absolutely no inversion, equivalent to a clear gain in the latter of 1·15 per cent. of extracted sucrose.

If the losses, aside from the double effect, had continued in the same proportion throughout the campaign as with stubble, they would have been increased by 10,954 pounds of sucrose; and if the same percentage of total losses, inclusive of that at the double effect, had continued, 49,343 pounds less of sucrose would have been secured. This, instead of the loss of extracted sucrose being 12,192 pounds, would have made it 61,535 pounds out of the 952,563 pounds of sucrose present in the juice.

The masse cuites of the plant run, like those of the stubble, were boiled very stiff, the first containing only 6·78 and the second only 6·62 per cent. of water. The first sugar made polarised 99·02, and the amount secured was 7·20 per cent. of the weight of cane worked. The second sugar polarized 81·67, and contained 4·24 per cent. of glucose.

Quite a good deal of second sugar ran through the sieves of the centrifugals. No reason could be assigned for this, or rather no proof in substantiation of any particular theory could be obtained, and no sieve, either of wire cloth or perforated plate, would stop it. The final molasses contained 40·82 per cent. sucrose, double polarization, 15·96 per cent. glucose, and had a purity of 50·89.

This molasses, on the basis of last year's work, would have given quite a large crop of crystals; but the manner in which the material had behaved during its working for seconds left no doubt that nothing satisfactory could be obtained by boiling for third sugars. The juices this year were not only more impure to start with, but the restraining influence upon crystallization possessed by these impurities appeared greatly increased as over previous years. This was especially noticeable in the lower products. The glucose was not very much in excess of that of last year's juice, which would indicate the correctness of Mr. Wibray J. Thompson's expressed belief that the restraining influence of glucose in preventing sucrose crystallization is not as great, pound for pound, as that of the non-sugar present in the juice.

The Gaunt Helix Separator.

The object in adding this apparatus to the double effect has already been mentioned. It will be noticed, however, that, notwithstanding the presence of the separator, there remains a heavy mechanical loss of sucrose at the double effect, reduced very much, however, in the last run as compared with the first.

It was noticed from the time the double effect was started that in the three-foot guage glass at the side of the separator the liquor stood at fully two-thirds the height of the glass.

The pipe intended to draw off the liquor collected from the vapours by the separator had been placed in the centre of the bottom casting of the apparatus, and it was not till seven days after the second run had been commenced that the cause of its failure to operate was determined. Mr. Wibray J. Thompson found that the centrifugal force of the vapour kept the liquor thrown against the side of the separator, preventing its reaching the return or drain-pipe leading back to the pan, and, at the same time, allowing the vapours, from the rapid motion given them by the helix, to carry it off through the condenser.

After this was found to be the case, it was soon remedied by putting the tail or return pipe at one side of the separator, thus drawing off

all the liquor collected. Unfortunately for determining the exact value of the apparatus, no separate run was made after this change, so it cannot be stated positively whether or not all loss was avoided. From the marked decrease in the loss at this point in the last run, it is certain that the separator was a decided aid, and, in my opinion, almost perfectly attains the object for which it was constructed.

TREATMENT OF JUICE.

Last year's practice of saturating the raw juice with sulphur dioxide fumes and leaving it very slightly acid was again maintained with no bad effect. There was, indeed, no inversion that could be attributed to sulphur, the small amount which did occur being due to unavoidable delay in working the juices.

This is the second year at Calumet in which the most careful chemical work could detect no inversion due to sulphur, and leaves no doubt that, where the sulphur dioxide is properly treated before its contact with the juice, there is no reason to fear inversion from it. There is at Calumet quite a quantity of sulphuric acid formed during the washing of the fumes, but this is all carefully trapped off before it comes in contact with the juice. Were Calumet to adopt diffusion, I should not, I believe, hesitate to recommend sulphuring the diffusion juice, even though it was drawn from the battery at a high temperature. If clarification was performed in the cell, sulphuring would, of course, be discontinued.

The clarified juice, as has always been the custom here, was concentrated to syrup immediately on getting enough to start the double effect, and no material was at any point held for settling, except in the clarifiers.

HOT AND COLD-WATER MACERATION.

Maceration was practised throughout the whole crop with the usual good results; but, as its merits have been so well proven, it needs no discussion here. There was, however, a trial of hot-water maceration, which lasted twenty-seven hours and fifty minutes, and which is worthy of some notice.

A table showing normal juice extracted in per cents. of cane for the run in which hot water was added, and for the runs just preceding and following it, during which cold water was added, is given below :

	Run previous to Hot-water Maceration.	Hot-water Maceration.	Run following Hot-water Maceration.
Mill extraction, per cent.	79·50	78·58	80·18
Tons cane ground per hour	16·58	15·35	18·05
Gallons juice made per hour	2,730	2,730	3,272
Dilution, per cent.	15·42	14·11	14·17

It has been supposed that the danger from hot-water maceration lay in raising the temperature of the mill juice, thus tending to increase inversion during sulphur saturation. There was, however, not the slightest loss from this cause; in fact, the temperature of the juice, as a whole, was raised but very slightly. A loss, however, did occur, and at a point where it had been least expected. The mill extraction was very perceptibly lowered, being 0·92 per cent. less than in the previous, and 1·62 per cent. less than the following run, extraction being expressed in terms of normal juice on weight of cane.

As far as absorption by the bagasse, there was no question but that hot water had a decided advantage. Here, however, the advantage ceased. The bagasse, by its absorption of heat and a larger quantity of water than in cold-water maceration, was considerably more distended, and the difficulty in feeding it to the mill was thereby increased. In fact, from the very time its use was begun, the back or maceration mill had to be "slacked up" to take the feed; and this continued to the end of the run, the number of tons of cane ground per hour falling off considerably at the same time. The poorer extraction would seem, then, to have been due to the lighter pressure which it was necessary to use with a rigid mill.

It is hoped that advantage can be taken of the better absorption of hot water by the bagasse during another campaign's work. A forced feed apparatus will be attached to the back mill, which will, it is thought, compel it to take as large a feed of hot bagasse with as high a pressure as it heretofore has taken during cold-water maceration without forced feed. At any rate, hot-water maceration will be given another trial during the next campaign.

Comparative Yield of Stubble and Plant.

It will be noticed that this year there is very little difference between the amount of sugar secured from stubble and plant-canes.

The juice of the stubble cane contained 0·62 per cent. more sugar than that of the plant. The cane, however, contained 0·68 per cent. more marc, and the mill extraction was lower, being 77·21 per cent. in the stubble, against 80·23 in the plant.

The stubble cane contained the most sugar, having 240·83 pounds per ton, against 231·48 pounds in the plant, and slightly more sugar was extracted from it, but a little less was crystallized, because of greater manufacturing loss in its treatment.

Available Sugar.

This year again proved the folly of predicting results on the amount of glucose present in the juice.

I cannot but again conclude that there is no necessity, and, in fact, no way of predicting results with any degree of accuracy from the amount of impurities in the juice. The character, as well as the amount of impurities, varies greatly, and this alone, aside from the difficulty of maintaining constant conditions in the manufacture, would preclude the possibility of a general formula.

Calumet Mill Work Compared with Diffusion.

Much has been said of late in regard to the work done at Calumet as compared with diffusion. It is well, therefore, to state as nearly as possible the difference which actually exists as based on this year's work. There was in the cane at Calumet 233·86 pounds of sugar per ton of cane. Of this the mill secured 203·97 pounds, leaving in the bagasse 29·89 pounds for each ton of cane entering the house.

Good average diffusion leaves in the chips about 7·5 pounds of sugar per ton of cane. Better than this has been done by diffusion for two or three consecutive weeks, and at least as good can be secured in regular work. Diffusion would then have given from the Calumet cane 226·36 pounds of sugar per ton, or 22·39 pounds more per ton than was secured by the Calumet mill. At five cents, net, per pound of sugar, including its pro rata of molasses, this would be an increase in value per ton of cane of $1·12. The dilution from maceration at Calumet was 13·62 per cent., the maceration juice requiring multiple effect, evaporation as much as diffusion.

With cane richer in sugar than the above, the advantage of diffusion would be relatively greater, from the fact that the loss in the chips remains constant with diffusion, while with the mill it varies with the quality of the cane worked.

NOTES ON QUANTITATIVE ANALYSIS.

By L. H. Friedburg, Ph.D.

(From the Journal of the American Chemical Society.)

The following chapters make but little claim to originality, and treat only of well known facts. But as every chemist during a long period of analytical occupation developes for himself a particular *modus operandi*, based upon results obtained, it is proper to recommend what he deems to be valuable. In this sense I offer the descriptions given below, omitting all reference to literature or authorship of the different methods; premising only that not *one* is described that I have not myself frequently used.

A. Acidimetry and Alkalimetry.

The test liquids used are hydrochloric acid and ammonium hydrate. It is customary to prepare normal or deci-normal solutions. With solids, provided they are pure, this may be arrived at to a degree of accuracy practically sufficient. With solutions of gases such as $H\,Cl$ or NH_3 the preparation of a normal solution, even if performed with the greatest care and the best, standardized measuring vessels or specific gravity apparatus, we cannot omit quantitative determination of at least *one* of the liquids prepared. The following figures will show that in trying to prepare normal solutions of the aforesaid liquids a difference of 0·1957 per cent. of H Cl and of 0·0740 per cent. of nitrogen were quantitatively determined. For very accurate work such determination ought to be made and no attempt to normalize afterwards by dilution or concentration is necessary or desirable. The measuring of new quantities of liquids is a source of new errors at best. The sacrifice of the advantage of rapid final calculation of results with such solutions is well balanced by greater accuracy obtained.

900 c. c. hydrochloric acid *puriss.*, Sp. Gr. 1·20, were mixed with about 8000 c. c. of distilled water, while 450 c. c. of the commercially pure, strong ammonium hydrate were added to about 6400 c. c. of dist. water. The mixtures were allowed to stand for a week. Then it was ascertained how these two liquids would neutralize each other by volume. The whole length of the burettes was used, and in the

last determination they were filled up again. It was found, using cochineal as an indicator, that :—

a. 20 c. c. H Cl were neutralized by 25 c. c. N H_4 O H.

b. 20 c. c. H Cl were neutralized by 25 c. c. N H_4 O H.

c. 20 c. c. H. Cl were neutralized by 24,95 c. c. N H_4 O H.

20 c. c. H Cl therefore corresponded to 25 c. c. N H_4 O H.

Next, three different weighed quantities of H Cl were taken and neutralized (using the same indicator) with ammonia. The results were :—

a. 19·7861 grms. H Cl required 24,30 c. c. N H_4 O H,
consequently 1 grm. H Cl required 1,228 c. c. N H_4 O H.

b. 5·8800 grms. H Cl required 7,20 c. c. N H_4 O H,
therefore 1 grm. H Cl required 1,224 c. c. N H_4 O H.

c. 15·4551 grms. H Cl required 19,00 c. c N H_4 O H,
or, 1 grm. H Cl required 1,229 c. c. N H_4 O H.

1 grm. H Cl, therefore, was neutralized by 1·23 c. c. N H_4 O H.

Finally, three chlorine determinations were made. The silver chloride was dried as usual, but only that part of it which would spontaneously leave the filter when emptied into the porcelain crucible was determined as horn silver, the filter and the remaining amount were burned in a weighed platinum spiral until the silver was reduced to a metallic state, adhering as a little knob to the wire, which was again weighed. Following are the results :—

a. 9,9710 grms. H Cl gave 1·66603 grms. Ag Cl equal to 0·42362 H Cl.

b. 1,8240 grms. H Cl gave 0·3023 grms. Ag Cl equal to 0·0769 H Cl.

c. 7,8802 grms. H Cl gave 1·31663 grms. Ag Cl equal to 0·33478 H Cl.

From these analyses the following amounts of H Cl in one grm. of the liquid were calculated :—

a. 1 grm. H Cl contains 0·04249 grm. H Cl gas.

b. 1 grm. H Cl contains 0·04218 grm. H Cl gas.

c. 1 grm. H Cl contains 0·042485 grm. H Cl gas.

A noticeable loss having occurred in the determination *b*, the average of *a* and *c* was taken ; 1 grm. H Cl contains ·04249 gaseous H Cl. The difference between the average taken from all three determinations, and of that from the two mentioned, however, is only 0·0001 grm.

From all the above it follows that:—

1 grm. $H\,Cl$ solution is neutralized by $=$ 1·23 c. c. $N\,H_4\,O\,H$ solution.
1 grm. $H\,Cl$ solution contains $=$ 0·04249 gr. $H\,Cl$ gas.
1 c. c. $N\,H_4\,O\,H$ solution contains $=$ 0·013264 grm. nitrogen.
1 c. c. $N\,H_4\,O\,H$ solution is neutralized by $=$ 0·8 c. c. $H\,Cl$ solution.
1 c. c. $H\,Cl$ solution contains $=$ 0·034543 grm. $H\,Cl$ gas.
or $=$ 0·033596 grm. chlorine.

These solutions were prepared in February, 1888. The $H\,Cl$ solution was kept in a large flask with doubly perforated rubber stopper, one hole of which allowed the escape of the liquid by means of a syphon (or self-feeding burette) while the second opening was connected with a small flask containing a few c. c. of the same liquid as the large one. The ammonia bottle was closed with a doubly perforated *cork*. A small flask, containing a little liquid of the same strength, a second small flask which is kept empty and finally a cylinder, containing cotton, solid KOH and again cotton, are attached, in the above sequence, to one opening, the other serving for the outlet of the liquid.

These liquids are kept standing in the laboratory, not exposed to direct sunlight, but subject to the natural variations of temperature during the year. Nevertheless, they have not changed during these last *two years* under the given conditions. To-day, as two years ago, 20 c. c. of the $H\,Cl$ solution is saturated by 25 c. c. of the ammonia solution, while both solutions, when used in a nitrogen determination of urea which had been six times recrystallized and finally dried over sulphuric acid, then heated with soda lime, was shown to have retained the previously determined percentage, the urea analysis yielding figures of *absolute* correctness.

AUSTRIA.

The *Deutsche Zuckerindustrie* is responsible for the statement that the first season in the Hungarian factories of the Steffen Syndicate has been anything but successful, the loss being about fl.1,000,000 = over £90,000. This is somewhat astonishing, after the great expectations that were formed of the probable success of these undertakings. It is further asserted that the Syndicate is threatened with a lawsuit for declaration of nullity of the patent granted for the Steffen process of clearing sugar, on the ground of its being no novelty.

NOTICES OF BOOKS.

Berichte der Versuchsstation fur Zuckerrohr in West-Java, Kagok-Tegal (Java). Heft I. Mededeelingen van het Proefstation voor Suikerriet in West-Java. Deel I. Edited by Dr. Wilhelm Krüger, Director of the Sugar Cane Experimental Station of West Java. Dresden: G. Schönfield's Verlagsbuchhandlung, 1890.

We have received the above volumes, the Dutch being simply a translation of the German original, or *vice versâ*, though, as Dr. Krüger's name probably indicates German nationality, the first supposition may possibly be the correct one. The name of Dr. Krüger will not be unknown to the readers of *The Sugar Cane*, he having already come into notice in connection with the *sereh* disease of the cane, and the discoveries and observations made by his predecessor (Dr. Soltwedel) and himself respecting that disease, and also in connection with the question of the reproduction of the cane from seed. The volume before us forms the first issue of what is intended to be a continuous series of papers detailing the results of observations made in connection with the sugar cane, its cultivation, growth, pests and diseases, chemical composition, and generally everything concerning the production of the plant and of the manufactured article. It consists of four divisions, three of them being written by Mr. H. Winter, who is apparently the chemist attached to the institution, as he deals exclusively with chemical questions, viz.:—

Division I.—Papers on the determination of the glucose in saccharine juices, the determination of the quantity of sugar in the cane, and the methods of obtaining and examining average samples in investigations connected with cultivation.

Division II.—The distribution of the sugar in the cane. The chemical constitution of the cane.

Division III.—Examination of certain substances which occur during the manufacture of sugar. Simple defecation by lime, without carbonatation.

The remaining division, which constitutes the larger half of the volume, is from the pen of Dr. Krüger, and relates to diseases of the cane, separate papers being devoted to the borer and the physopoda (thrips, &c.), vegetable parasites, such as brand (ustilago), red blotches (cerospora), rust (uromyces), a fungoid disease of a sclerotic

type, other diseases of unknown origin, but probably vegetable, and preliminary remarks on the formidable *sereh* disease. So far we have given merely an enumeration of the contents, obtained chiefly from the index, but this is sufficient to show the valuable and interesting nature of the publication.

The chemical portion of the present volume, which may be considered as chiefly introductory, will be found to contain some views differing from those most generally received. For instance, Mr. Winter, in speaking of the quantitative determination of glucose avows a preference for the method, slightly modified, of Sidersky by alkalimetry, and considers that he has obtained regular and satisfactory results from the mode which he has adopted. The question of how far the quantity of sucrose ultimately obtainable from a given cane can be at all satisfactorily ascertained by any determination of the glucose in the cane juice cannot be regarded as settled, and like many other purely scientific methods of investigation it may have been carried too far in one direction, or too much dependence placed on it, and so have been misleading in its results.

Probably the portion which will be most highly appreciated by sugar cane planters and the specialists attached to the various botanical gardens and similar institutions in the West Indies, &c., will be this latter division, though naturally the chemical phenomena, which present themselves under such special circumstances as those obtaining in the Dutch East Indies, will be followed eagerly and carefully by chemists in all other parts where cane sugar is manufactured.

As regards the diseases of the cane, parasitic or otherwise, it seems to be a law that all plants or animals subjected to intensive cultivation and removed to some extent from their original surroundings, sooner or later become subject to special diseases of one character or another, and as the intelligent study of these is of comparatively modern growth, and their development seems to have been assuming greater proportions, the interest attaching to such investigations and communications as these is sure to be an increasing one.

Dr. Krüger, however, does not share the common opinion in regard to the greater susceptibility of cultivated products owing to steady degeneration. This matter we must leave to those whose studies best fit them for the consideration, but it appears to us that the general idea on these points will not easily be shaken. The theories and hypotheses as to the origin of these parasitic and similar diseases, are

carefully discussed and submitted to examination in the light of the author's experience.

It is much to be desired that these communications, interesting as they do a public to a very large extent consisting of those unacquainted with German or Dutch, could be issued in English. Even in the German edition long quotations are occasionally given in Dutch, and the number of those in our colonies acquainted with that language is undoubtedly limited. The publication will then, if carried on in its present form, be mainly read by those specialists who have enjoyed the benefit of that higher education which includes the principal modern languages.

We scarcely feel able to pronounce fully on the real merits of the book, but the editor's name should form a guarantee for solidity and careful arrangement of the details of observations which cannot fail to be valuable from the position and ability of the investigators, and the unique advantages and opportunities which they enjoy for prosecuting their labours.

The volume, neatly and well bound, contains eleven well drawn plates of the insect and vegetable parasites, some of them carefully coloured, and is superior in "get up" to anything of the kind that has lately appeared.

We shall look forward with interest to the appearance of the second part, which is to follow very shortly. Meanwhile, we think directors of experimental stations and botanical gardens in the colonies will find this publication indispensably necessary in their researches, and may possibly be able to add to or even correct some of the results already obtained by Dr. Krüger.

GERMANY.

On the 1st of last month the well-known Sangerhäuser Maschinenfabrik & Eisengiesserei (formerly Hornung & Rabe), of Sangerhausen, in Germany, entered on its 26th year of activity. To celebrate the occasion the employés and workmen waited upon Herr Hornung, the former head of the concern, with a band of music to express their congratulations, and the evening was enlivened by a torch-light procession.

On the same day, at Tangermünde, similar festivities celebrated the 25th anniversary of the day when the sugar factory (now refinery) was taken over by the present owners—Fr. Meyers Söhne, formerly Gebr. Meyer. During this period the production of the factory is stated to have reached 6,000,000 centner.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO JUNE 30TH.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Germany	3,254,222	3,615,556	2,697,982	2,135,633
Holland	282,639	236,448	230,998	131,563
Belgium	459,833	458,796	316,986	242,206
France	98,781	817,692	83,992	503,840
British West Indies & Guiana	1,238,651	767,898	1,157,165	582,329
British East Indies	739,083	267,322	511,243	131,924
China and Hong Kong	9,831	....	7,139	....
Mauritius	147,956	78,166	155,717	49,012
Spanish West India Islands	46,400	....	41,890	....
Brazil	695,192	221,851	497,178	132,894
Java	727,991	738,392	698,218	531,778
Philippine Islands	257,805	126,964	167,804	68,366
Peru	261,996	370,285	210,745	247,144
Other Countries	413,060	167,729	350,940	117,826
Total of Raw Sugars	8,633,840	7,867,099	7,127,997	4,874,515
Molasses	243,348	321,942	88,325	106,020
Total Sugar and Molasses	....	....	11,660,196	9,113,766
REFINED SUGARS.				
Germany	2,367,095	2,612,747	2,377,728	2,116,641
Holland	707,003	916,610	716,175	761,841
Belgium	143,019	80,316	150,372	72,739
France	751,692	1,397,123	778,255	1,133,071
United States	8,586	56,240	7,799	47,919
Other Countries	448,248	1,268	413,545	1,020
Total of Refined	4,425,643	5,064,304	4,443,874	4,133,231

EXPORTS.—REFINED SUGARS.

	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Sweden and Norway	38,741	26,008	32,852	18,645
Denmark	57,299	66,170	45,882	40,748
Holland	40,010	44,938	30,420	31,713
Belgium	13,599	13,891	9,689	9,522
France	4,802	4,255	3,639	2,754
Portugal, Azores, & Madeira	25,209	50,165	18,532	33,144
Italy	43,846	46,559	37,119	31,352
Other Countries	66,093	119,237	57,156	89,814
Total of Exports	289,599	371,223	235,289	257,692

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of June, 1890, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1887, 1888, and 1889, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				June	June	June	Monthly Average.				June	June	June	Monthly Average.				June	June	June
	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France	1363	1686	1888	3398	1567	2382	3245	5099	4855	3398	8245	905	5003	8665	6462	6541	5286	11643	2472	7385	11910
Holland	3780	3267	3005	3137	4235	2230	3078	2483	2675	3074	4501	2735	3307	6112	6263	5942	6079	7638	6970	5537	9190
Germany & Austria	1347	1510	2964	2872	1503	2620	2986	10463	11729	17245	18901	12510	12076	21273	11810	13239	20209	21773	14013	14696	24259
Belgium	592	622	995	425	414	1088	305	308	227	267	244	320	177	400	900	849	1262	669	734	1265	705
United States	454	8	..	38	...	..	..	2804	157	98	431	186	13	1746	3258	165	98	469	186	13	1746
Russia	3	..	..	..	..	249	..	452	1959	4275	..	2463	1627	..	455	1959	4275	..	2463	1876	..
Other Countries	..	1	14	..	..	294	..	15	2	10	10	4	390	27	15	3	24	10	4	684	27
Total	7539	7094	8866	9870	7719	8863	9614	21624	21604	28367	32332	19123	22593	38223	29163	28698	37233	42202	26842	31456	47837

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

To July 19th, 1890 and 1889. In Thousands of Tons, to the nearest Thousand.

	Stocks. 1890.	Stocks. 1889.	Deliveries. 1890.	Deliveries. 1889.	Imports. 1890.	Imports. 1889.
London	33	52	147	178	132	196
Liverpool ..	63	58	157	172	134	135
Clyde......	37	29	125	138	121	154
Bristol	2	2	41	34	40	32
Total ..	135	141	470	522	427	517
	Decrease.. 6		Decrease..52		Decrease ..90	

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Circular.)

For the four principal Ports. In Thousands of Tons, to the nearest Thousand. For June, 1890 and 1889.

	Stocks. June 1st. 1890.	Stocks. June 1st. 1889.	Deliveries. In May. 1890.	Deliveries. In May. 1889.	Imports. In May. 1890.	Imports. In May. 1889.
New York	32	25	57	56	62	61
Boston	5	3	18	10	19	12
Philadelphia....	4	3	29	28	31	28
Baltimore	..	..	..	..	..	..
Total......	41	31	104	94	112	101
	Increase.. 10		Increase .. 10		Increase .. 11	
Total for the year			659	584	688	582

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, July 17th, 1890.

Fair Refining.	96o/o Centfs.	Granulated.	Stand. A.	Stock in Four Ports.
July 17, 1890.—4 13-16c.	5 7-16c.	$6\frac{1}{4}$c.	6c.	Jan. 1, 1890— 11,169 tons.
July 18, 1889.—$7\frac{1}{8}$c.	$8\frac{1}{8}$c.	$9\frac{1}{4}$c.	9c.	Jan. 1, 1889— 32,254 tons.
July 19, 1888.—$5\frac{1}{4}$c.	$6\frac{1}{8}$c.	$7\frac{3}{4}$ 13-16c.	$7\frac{1}{2}$-$\frac{3}{8}$c.	Jan. 1, 1888— 47,798 tons.
July 21, 1887.—$4\frac{1}{2}$c.	$5\frac{1}{4}$c.	5 15-16c.	$5\frac{1}{2}$c.	Jan. 1, 1887—102,279 tons.
July 22, 1886.—4 13-16c.	5 7-16c.	6 3-16c.	$5\frac{3}{4}$c.	Jan. 1, 1886— 57,328 tons.
July 23, 1885.—$5\frac{1}{8}$c.	6c.	$6\frac{1}{2}$c.	$6\frac{1}{8}$c.	Jan. 1, 1885— 89,186 tons.
July 17, 1884.—5c.	5 15-16c.	$6\frac{7}{8}$c.	6 7-16c.	Jan. 1, 1884— 60,900 tons.
July 19, 1883.—6 11-16c.	$7\frac{5}{8}$c.	8 15-16c.	$8\frac{1}{2}$c.	Jan. 1, 1883— 50,297 tons.
July 20, 1882.—$7\frac{1}{4}$c.	8 1-16c.	$9\frac{3}{8}$c.	$8\frac{7}{8}$c.	Jan. 1, 1882— 43,927 tons.
July 21, 1881.—$7\frac{3}{4}$c.	$8\frac{1}{2}$c.	$9\frac{7}{8}$-10c.	9 7-16-$\frac{1}{2}$c.	Jan. 1, 1881— 66,999 tons.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 30TH JUNE, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal *entrepôts.*	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
143	170	160	110	28	22	633	419	616

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 30TH JUNE, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal *entrepôts.*	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
1303	436	490	278	48	373	2928	2835	2648

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.	1886-87. Tons.
German Empire	1,260,000	990,604	959,166	1,012,968
France	800,000	466,767	392,824	485,739
Austria-Hungary	750,000	523,242	428,616	523,059
Russia	470,000	526,387	441,342	487,460
Belgium	210,000	145,804	140,742	135,755
Holland	60,000	46,040	39,280	36,098
Other Countries	80,000	87,000	79,980	69,127
Total	3,630,000	2,785,844	2,481,950	2,750,206

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

After long continued inactivity the cane sugar market has assumed an improved appearance, due to a large extent to sympathy with the greater activity displayed in beet sugar. The improvement has, however, been partial, several sorts closing at about the same rates as last month.

In beet sugar a decided steady advance has characterised each week's prices, and the closing prices of the month are from 1s. 6d. to 1s. 9d. above those of June. Were it not for the large excess of production this year, and the caution observed by buyers, joined to the belief that the coming crop is likely to be a large one, we should have had very much higher prices to report. In continental refined there is an advance of about 9d., and on English refined sorts of about 6d. In view of the very large imports of white sugar, amounting to some 10,000 tons weekly, a determined effort has been made by the wholesale trade in our principal towns to ensure proper execution of contracts by foreign producers, who up to now have been acting in a very arbitrary manner as regards both quality and time of delivery.

The principal feature in the statistics for the last week of June and the three first weeks of the present month is the decrease of 90,000 tons in the imports, and of 52,000 tons in the deliveries, as compared with the same period last year.

Present quotations for the standard qualities, as under, are:—

Floating.			Last Month.
Porto Rico, fair to good Refining	12/9 to 14/-	against	12/9 to 13/9.
Cuba Centrifugals, 97°/$_{o}$ polarization	14/6 to 14/9	,,	14/3.
Cuba, fair to good Refining	13/- to 13/6	,,	12/9 to 13/3.
Java, No. 14 to 15 D.S...	15/3 to 15/6	,,	14/6 to 14/9.
British West India, fair brown..	12/3	,,	12/-
Bahia, low to middling brown	10/3 to 11/-	,,	10/3 to 11/-.
,, Nos. 8 to 9	11/6 to 12/-	,,	11/6 to 12/3.
Pernams, regular to superior Americanos.	10/9 to 12/6	,,	11/- to 12/9.
Landed.			**Last Month.**
Madras Cane Jaggery..	10/-	against	9/9 to 10/-.
Manila Cebu and Ilo Ilo	9/9	,,	9/3.

Paris Loaves, f.o.b...	16/3 to 16/6	against	15/6 to 15/9.
Russian Crystals, No. 3, c.i.f.	No business.		
Titlers	18/6	,,	18/-
Tate's Cubes..	19/6	,,	19/-
Beetroot, German and Austrian, 88%, f.o.b.	13/9 to 13/10½	,,	12/3

THE SUGAR CANE.

No. 254. SEPTEMBER 1, 1890. Vol. XXII.

☞ The writers alone are responsible for their statements.

CHANGE OF ADDRESS.

All communications to be addressed to "The Editor of the Sugar Cane, Manchester."

For Table of Contents, see page i.

We publish this month a letter from an esteemed correspondent, Mr. W. H. Jones, which, but for an inadvertence, would have appeared in our columns last month. The substance of this has already appeared, in the meantime, in the *Manchester Examiner and Times*, in answer to some statements which our correspondent thought unfair to Professor Harrison. This has elicited a rejoinder from Mr. Morris in a letter addressed to the editor of the *European Mail*. As we are not desirous of taking any partisan view of the case, and as Mr. Morris has kindly sent us a copy of his letter, we have decided to reprint the letter *in extenso* (long as it is), rather than give a summary of its contents, leaving our readers to judge of the merits of the question at issue, the more so as we might inadvertently be unfair to one or the other party by attempting to condense it. We may observe, however, that Mr. Morris' wish, that Mr. Bovell might receive some due recognition of his services, has been gratified, as we are glad to learn that to mark their appreciation of his value to the island, the authorities of Barbados have made a substantial addition to his salary.

As Mr. Morris has alluded to the Barbados experiments having been anticipated in Java, we would just remark that we are under the impression that the real priority of discovery of the possibility of producing sugar cane from seed, and the absolute determination of this fact by the isolation of the seed and by raising plants from it, belongs

to Dr. Soltwedel, of the Samarang botanical station. (See *Sugar Cane*, for October, 1889.) Such, at least, is the statement of Dr. Krüger, now at Samarang, who will, no doubt, correct us if we are in error. The fact of the priority of discovery in Java, of course, in no way detracts from the honour attaching to Professor Harrison's discovery, as neither he nor Mr. Bovell were aware of what was being done in the Eastern Indies.

A paper was read last month at a meeting of the Society of Public Analysts, by Mr. Charles E. Cassal, on "Dyed Sugar." In June, 1889, we published an article by Dr. Phipson, on the effect upon health of the tin salts now being used for colouring sugar. It appears this sugar is regularly being sold as "Demerara," though in many cases having no connection with the West Indies, and not being cane sugar at all. The question of what constitutes adulteration is an exceedingly difficult one, in face of the fact that all but the very coarsest brown sugars are more or less artificially coloured. The discussion which followed the reading of the paper did not settle the position of the public analyst in face of the question whether he ought to certify these sugars as adulterated. It seems to us that if the Demerara exporters (say the Colonial Company), would pack their sugars in small packages properly labelled as being of *Demerara origin*, the public who wished to have real Demerara, and not beet sugar got up to resemble the genuine article, would be in a position to have their wishes gratified, and would not object to pay the extra cost resulting from the special packing.

Judging from the prices which Sugar Trust Certificates have commanded during the past month, the judgment of Messrs. Willis and Gray, quoted in our last number, that "their securities would appreciate in public estimation," is being fully justified.

We have received a copy of the Judge's decision in the U. S. Circuit Court, Eastern District of Pennsylvania, in the suit of the Sugar Apparatus Manufacturing Company *v.* the Yaryan Manufacturing Company, which substantially agrees with the statement given in our last month's issue. One of the patents involved dates as far back as 1878, but the suit was for infringement of Mr. S. Morris Lillie's two patents of May 11th, 1886, and February 28th, 1888.

The following is from the *Barbados Agricultural Gazette*, and may be read in connection with the tables of results of the use of "Early Cane Manure" given in our July number. "The merits of the 'Early Cane Manure,' recommended by our chemists for application to plant canes when in their infancy, are being pretty generally recognized, and many tons, at the rate of 2½ cwts. per acre, are now regularly applied throughout the island, in December, January, or February, according as there has been a late or early planting of the canes. The infant plant being thus supplied with suitable food, an early, strong, and vigorous growth is secured, and this certainly increases the return per acre. On the whole, foreign fertilizers are much more extensively and liberally, and withal intelligently and judiciously applied than was the case some few years ago, and this in a great measure accounts for the recent increase of 25 per cent. in the crops. It is true the island has been favoured with good seasons, but formerly in the best year its crop never exceeded 50,000 hogsheads, whereas the crop of 1888 reached 72,500, and that of this year (1889) something over 66,000, while the one now about to be reaped promises a return greater than either of these two previous years. The best means of prevention, it cannot be too often repeated, for all insect pests in the cane field, is manure."

The following remarks in a letter to the *Barbados Agricultural Reporter* of July 26th, so fully agree with what has often been said in these columns, that we cannot forbear reproducing them, coming as they appear to do from a competent quarter. "It is only by the introduction of the best crushing machinery, the amalgamation of small estates, and the extensive use of chemical fertilizers to the soil, that estates will be able to hold their own against all comers in the world, and the sooner some steps are taken to accomplish these objects the better it will be for all parties concerned. For those plantations which cannot produce three tons to the acre there is very little hope, and it would be as well to turn their attention to other crops without delay."

It is pleasant to note that in the Barbados House of Assembly a substantial increase of salary was spontaneously voted to Mr. Bovell for his exertions and valuable assistance in the work at the Botanical Station.

We have received the issue for 1890-1891 of that very well compiled little publication "Liste Générale des Fabriques de Sucre de France, de Belgique, de Hollande, d'Angleterre, d'Allemagne, d'Autriche-Hongrie, et des Colonies; &c., &c." We notice that it is up to date in all matters on which it treats, and that the details of the sugar laws have been extended to all European countries, but it seems almost a pity not to have waited for the new French legislation. But then, who could have expected that the Government proposals would pass at such a railroad pace into law?

The Revised Customs Tariff has been passed by the Natal House of Representatives. The report of the *Natal Mercury* contains the following passage of interest:—"It was shown that colonial sugar is unsuited for the manufacture of aërated waters and 'sweets,' which are more and more becoming a subject of local production, and a vigorous effort was repeatedly made to reduce the duty upon 'refined'—or lump—sugar imported from abroad. The result finally arrived at was that the transit rate of 1d. per lb. on confectionery was maintained, but the terms of the law passed last session were modified so as to empower the Governor in Council to grant a refund of duty upon refined sugars used in local manufactures. The question is a somewhat difficult one, as beetroot sugar is now sold at prices which are less than the market prices of colonial sugar, and there is a danger that the market of the inland States, now commanded by our own planters, may be supplied by imported sugar. The tariff as it stands, however, provides for a duty of 3s. 6d. per cwt. on unrefined, and of 1d. per lb. on refined sugar, so that the planting interest has no reason to complain of inattention to its requirements."

A small supply of the American sorghum seed has been received, and experiments will be made at the Experimental Station, Cawnpore.

The Report of the Mauritius Sugar Estates Company presents the following very satisfactory items, taken from the *Merchants and Planters' Gazette*:—

The report extends over a period of twelve months. The properties of the Society are four, namely: L'Etoile, Riche Bois, La Rosalie, and Astrœa, the three principal of which (first named) have produced, after deduction being made for the costs of *faisance valoir* in capital and interest, the sum of Rs. 469,036·09.

The profits have been realised as follows :—

By l'Etoile..	Rs. 153,300·92
,, Riche Bois..	215,816·20
,, La Rosalie	99,918·97
	Rs. 469,038·09
Fees on transfers	172·00
	Rs. 469,208·09
All the produce of Astrœa during the past year has been absorbed by the costs of *faisance valoir,* increased by the expenses of putting in thorough repair the mill, reconstructing the labourers' camp, and introducing men from India. The result was a balance of	598·57
Deducting from the sum of	Rs. 468,609·52
That of	79,222·18
for general costs and interest upon the debt of the company there remains a net balance of..	Rs. 389,387·34

That is to say 20·47 per cent. upon the sum total of the shares in circulation.

The company has paid off during the past year the sum of Rs. 93,392·17 on its mortgage debt. The state of cultivation of the four estates is in a most satisfactory condition.

The directors have decided to give the shareholders a dividend of 15 per cent.

After payment of this dividend, there will remain disposable for this year	Rs. 12,093·54
To which must be added the balance from last years.	Rs. 63,887·46
Total amount disposable after payment of dividend	Rs. 75,981·00

From which sum it will be necessary to deduct the directors' fees, and the rewards which they consider should be given to the administrators and employés of the Company.

Owing to want of space we have had to suspend our accounts of the profits shown and dividends declared by German and other Continental Companies, which are now beginning to present their annual balance sheets. The following are the results already announced :—

DIVIDENDS DECLARED.

Schöppenstedt (capital, M. 399,000), will pay 40%. *Culmsee* (capital, M. 1,300,000), pays 10%, besides placing M. 11,140 to reserve and

paying M. 81,676 towards clearing off the debt. *Rastenburg* (capital, M. 400,000), pays 10%, and places M. 5,000 to special reserve fund. *Dirschau* (capital, M. 450,000), 10%. *Glauzig* (capital, M. 4,500,000), $8\frac{2}{3}$%. *Körbisdorf* (capital, M. 2,700,000), 5%. *Rositzea Zuckerraffinerie* (capital, M. 6,000,000, half of this sum being in shares in the Strontianit-Societät), declares a dividend of 7%. *Dirschau-Ceres* declares no dividend, but places M. 47,700 to the reserve funds (now amounting to M. 140,000); partly because the intention is to pay no dividend until half the cost of erection is cleared off, and partly as foreseeing less profits from greater cost of beets, of the cost of manufacturing, and lower prices of sugar.

Net Profits Shown.

Rostocker Actien Zuckerfabrik (capital, M. 600,000), M. 235,976. *Doebeln* (capital, M. 690,000), M. 160,000. *Uelzen* (capital, M. 780,500), M. 38,384. The sugar factory of *Radegast* i/A, according to the *Prager Zuckermarkt*, has made a net profit of M. 202,046, of which M. 13,541 is placed to reserve, the remainder being equal to 71% of its capital. *Hamburger Zuckerraffinerie.*—The establishment of a large refinery under this title at Wilhelmsburg, near Harburg, is decided on. The share capital is to be M. 1,000,000, of which a large proportion has already been subscribed. A new German company has been formed, with a capital of M. 825,000, under the name of Actien-Zuckerfabrik Rossleben, taking over two existing smaller factories.

Austria-Hungary.—*Dolloplass* has made a net profit of fl. 71,923 (£6,000). *Schlappanitz* (Moravia), 10%. *Predmeric* (Bohemia), 15%. *Mescherin*, 10%. At *Tobitschan* (Moravia) a new factory is being erected by Herr D. Ritter v. Guttmann, on his estate, to commence work next year, and work up 400 tons of beets daily. It is worth noticing that the Oedenburg Candis-Zucker Factory, the only one of its kind in Austria, which has just changed owners, was the *first sugar factory established in Hungary*, and dates from the year 1794.

The great Ungarische Zuckerindustrie Gesellschaft, belonging to the Steffen Syndicate,—respecting which we last month inserted a report that was current to the effect that it had lost about fl. 1,000,000 on its first season's working,—has published the statement that although a great portion of last year, which they consider as only a trial year, was devoted to the erection of buildings and machinery, the campaign closes without loss, and the new campaign is being commenced under very favourable auspices. The great new refinery which is to be established as Aussig (Bohemia) by Carl Steffen, in conjunction with

the bankers Rothschild, Baring Bros., and Bleichröder, with a capital of M. 10,000,000, is to work up 5,000 sacks of raw sugar daily, and would consequently divert from its usual channels a very large quantity of the raw sugar now exported. It is thought that the execution of the project will very probably be delayed by the action for nullification of patent brought against Carl Steffen's Consortium by Prof. Scheibler.

The Union of German Sugar Merchants, formed three months ago, (which includes the whole of Germany, with its central seat at Magdeburg), has been negotiating with the Refiners respecting a proposed *strike-clause* to be introduced into all contracts for delivery, by virtue of which the latter are to be declared null and void if unable to be carried out for a period of three months in consequence of strikes. Up to now the refiners would only agree to a term of six weeks. The matter is to be finally discussed at a general meeting in Berlin.

At a general meeting of the Union of German Sugar Manufacturers, held at Hamburg on the 22nd May, the question of whether the late discoveries in the direction of the synthesis of sugar had any practical bearing on the position of the German sugar industry, was decided in the negative, the costliness of the operation effectually excluding for the present any idea of commercial competition.

ITALY.—A beet-sugar factory is to be established at Savigliano, near Cuneo, about 30 miles south of Turin, with a provisional capital of fcs. 500,000, to be afterwards increased to fcs. 4,000,000.

SWEDEN.—The new beet-sugar factory, the forthcoming erection of which we announced in our July number, is at Oertofta (not Krofta), and the title is to be the Oertofta Socker-Fabriks-Actiebolag.

SACCHARINE.

In Bavaria, all articles of food which owe their sweet taste to saccharine are to be regarded for the future as adulterated, and coming under that head by virtue of the law relating to food.

It is reported that the Russian Government, which had hitherto classed saccharine amongt the medicines, is about to forbid its import.

On the 12th August, a traveller coming from Germany was arrested on the Belgian frontier with 40 kilos. (88lbs.) of saccharine in his possession, the duty on which is 61,000 francs (£2,440). The smuggling of saccharine into Belgium has long been suspected.

FRANCE.

THE NEW SUGAR DUTIES.

The French proverb, "It is only the unexpected that happens," has found ample verification in its native country. The proposed new sugar legislation, which at the time we went to press with last month's issue it was generally thought would occupy many days of doubtful debate, has been "rushed" through both Chambers and passed into law at a pace which indicated a fixed determination to put an end to the deficits annually resulting from the régimes hitherto in force. Another French proverb says, "All things are possible in a republic," and we will therefore simply record that under the new law the "excédents" are subjected to an increased duty of 30 francs per 100 kilos., in place of 20 francs. This means that the quantity of sugar in excess of or exceeding (excédant) the legal yield will pay 50 per cent. more duty than it did in 1889. The refiners are also to work under supervision, and to pay duty on the excédents which they deliver for home consumption. The Refiners' Union is so powerful that they will probably succeed in recouping themselves entirely by reducing the price which they pay for the raw sugar.

The Syndicate (Central Committee) des Fabricants de Sucre, alluding to the off-hand way in which all its representations have been treated—the Report of the Commission of the Senate having really been drawn up before the Rapporteur, M. de Verninac, had even heard their deputation—says:—

"This is the way they treat an industry which is at this moment the first among the exporting industries in France, and in the prosperity of which are involved the interests of a district which most powerfully contributes to the maintenance and development of the national wealth."

But when we come to read the exposé of the facts which the Report of M. Frances Charmes lays before us in justification of the proposed legislation which has now passed into law, we no longer wonder at anything except that a Treasury which is so notoriously chronically in deficit could so long have borne the drain on its resources which the enormous premiums and bounties have kept up. We leave the following extracts from this *Rapport de la Commission du Budget* to speak for themselves, and place them on record for future reference when the history of bounties comes to be referred to.

Speaking of the famous law of 1884 we are told:—

"The legal yield having been fixed for the three first campaigns at 6 or 5%, according as the factories used or did not use the diffusion process, the *real yield* was 7·27 for 1884–85, 8·12 for 1885–86, and 8·87 for 1886–87. The quotas of excédents as compared with the real production were respectively 22·56, 31·21, and 36·44 per cent. for the three campaigns. The excédents as ascertained, including the deduction of 8% allowed to the factories which did not at first accept the assessment, excédents which completely escaped taxation, and the premiums gained by the home industry were as follows:—

	1884-85.	1885-86.	1886-7.	
Excédents absolutely free..	39,644,536 ..	77,953,676 ..	157,780,391	kilos.
Premium................	19,824,268 ..	38,976,838 ..	78,890,349	francs.
Adding the premiums of the colonial industry the total premiums were....	25,364,177 ..	43,955,072 ..	90,779,489	francs.

"During the years 1884 and 1885 the calculations as to the amounts receivable by the Treasury were realised and even exceeded, but in 1886 there was a deficit of 33,674,684 francs, which in the following year reached 36,835,397 francs."

The legislation which now became inevitably necessary had the effect of diminishing the deficit, which "in 1888 was reduced to 8,194,472 francs, but rose again to 25,448,000 francs in 1889."

The calculations furnished by the Commission fix the probable deficit for 1890 at 35,192,200 francs.

The rate of progress of the agricultural and manufacturing sugar industries is attested by the facts that "the legal yield had been fixed at 7% (of the weight of beets) for 1887–88, the real yield was 9·62%. Fixed at 7·25% for 1888–89, it was 9·83%. Legally for 1889–90 it is 7·50, but it will exceed 10·25%, and it may be expected to reach 10·50% if even it has not already attained that limit."

"The total premium for the home and colonial industry reached 68,985,475 francs in 1887–8, and 58,944,813 francs in 1888–89. In five consecutive campaigns, from 1884–85 to 1888–89, the total premiums granted to the sugar industry amounted to 288,092,026 francs (£11,500,000), being an average of 57,605,805 francs annually. But in reality, during the three last campaigns, the average premium has been 72,903,259 francs" (£2,900,000).

SUGAR BOUNTIES.

With the first day of last month, the term fixed for the ratification of the London Convention expired, and the question of any international agreement for the abolition of bounties on sugar exportation may be considered as finally disposed of for at least some years. Indeed the remarks of Baron de Worms to the deputation at Liverpool on the 9th April last, which are reported in full in the *Sugar Cane* for May, fully indicated the inevitable failure of the attempt to bring about an international arrangement. Baron de Worms did his best, and we do not think anyone could have done better. The influential men who have been engaged heart and soul in the abolition of these bounties undoubtedly did their best. We are disposed to credit the German government with a perfectly honest intention in the matter; but it was not to be. And the question arises, would the general abolition of the bounties have been sufficient to put our colonial producers in a position to recover the preponderant position which they once occupied in the English market? We think not. Now that the time for special pleading has gone by, and we have to look matters squarely in the face, we are of the opinion that the perfection in cheap production of sugar, which has been reached by at least the German manufacturers and agriculturists, and which is fast being attained by the French, would still have enabled them to supply sugar in Europe, and probably in America, at a price sufficiently below the cost of production in our Colonies to put them in a position to hold their ground. It is really crying over spilt milk to talk any more about the bounties, though we cannot but hail the possibility that at no distant date the situation may be even materially improved by the voluntary abolition of the German bounties, as it is to some slight extent alleviated by the reduction in the profits of the French manufacturers and refiners, consequent on the new fiscal régime which has just been so suddenly inaugurated in France. But we would repeat the remarks which we made on this subject in our May issue, "that the retirement of Fürst Bismarck renders less likely the arbitrary passing of any measure which may be opposed to the wishes of a large class who are deeply interested in the maintenance of things as they are. The Emperor evidently means to pay more regard to the feelings of the various classes of the community than was the case under the Iron Chancellor's rule, and we venture

to doubt whether the measure indicated will be introduced for the present. The abolition of the bounties will be energetically resisted by the greater portion of the German sugar manufacturers." These remarks, in spite of the endeavour being made in the *Berliner Tageblatt* and one or two other papers to get up an agitation against the bounties, and to favour the simple tax on the consumption, still fairly describe the situation, though we do not believe that there is any likelihood of the establishment of a fixed premium, in which direction some propositions have been made.

What the producers of cane sugar have to look to, and that to the attainment of which they must lend all their energies and direct all their available capital, is the reduction of the cost of production. In the very first rank of any efforts in this direction stands the use of the best and most improved machinery. We have endeavoured from time to time to keep our readers informed of all that is being done in this direction in foreign countries, and have given all data that we considered trustworthy for arriving at some judgment as to the comparative merits of Mill-work *v.* Diffusion, and it is for those most nearly interested to judge and decide. The question as to which is preferable in the Colonies cannot be considered as settled. We give this month in full a most interesting contribution to the discussion of this question by Mr. Nevile Lubbock, which will be found at pages 472 to 477, and it must be allowed that the opinion of so eminent an authority carries great weight. On the other hand, it cannot be denied that good results are being obtained with diffusion in Cuba and other cane-growing quarters. The one certainty, however, to which we can point, is the undoubted fact that delay is more than ever dangerous. The extraordinary rapidity with which the beetroot sugar production has overtaken that of the cane and completely reversed their respective positions, cannot be ignored. To maintain this position, in which a very large amount of capital is involved, the greatest intelligence of the day as regards agricultural, chemical, and scientific attainments, is doing its utmost on the Continent of Europe, and it is not too much to say that the cane-sugar producing interest must meet this state of things with equal arms, or the result will be very disastrous. Surely the richest nation in the world, the greatest producer of machinery, second as we may fairly believe to none in intelligence and activity, will not quietly allow itself to be beaten out of the field. And surely, in face of the results obtained by our competitors, there can be no undervaluing the strength of the opponents with whom the cane-sugar industry may be said to be engaged in a commercial contest that admits of no relaxation, unless the struggle is to be resigned to those who have already gained no inconsiderable advantage.

SEEDLING CANES IN MARTINIQUE.

The *Propagateur* announces with great satisfaction that, following the indications obtained from the experience of Messrs. Harrison & Bovell in Barbados, MM. Littée, proprietors of the estate of Morne Etoile, have also met with canes which have grown spontaneously from seed. The journal states :—

"We also possess canes which have grown from seed on our soil. We have just seen one of these interesting and valuable samples of a recent discovery. The little plant which has been submitted to our examination has already issued from the sheathing leaves. It is firm and upright, slightly tinged with brown, 15 centimetres high, and has put forth five vigorous small leaves, and presents an elegant and perfect miniature of the precious plant. To the eye of a creole it is unmistàkeable.

"This is not the case in the first days of its existence. The remains of the first leaflets, half withered on the stem, permitted us to verify what Messrs. Harrison & Bovell have stated, that on issuing from the soil the young wilding resembles anything rather than the cane. In fact one would say it was a young rush shoot, or a sprouting blade of the grass known under the name of *cabouya*, which grows on our savannahs.

"It is worth while knowing how Messrs. Littée obtained their plants, for they have a considerable number of them. What has taken place at Martinique is almost a textual reproduction of what happened at Barbados.

"As is well known, Messrs. Harrison & Bovell, possessed with the idea that the cane could and ought to be reproduced from seeds, not only devoted themselves to the methodical observation of all the plants growing in the neighbourhood of their experimental station at Dodds, but caused a similar surveillance to be exercised by the employés of that establishment. One fine day they were informed that the existence of a kind of grass, differing from those usually observed, had been noticed. This grass was the cane in the first period of its growth.

"The same thing happened at Morne Etoile. Having been made aware of the discovery of Messrs. Harrison & Bovell, and the circumstances attending it, and being kept on the alert by the information which we and some of our contemporaries have regularly published

on this subject, Messrs. Littée adopted the same method, and arrived at the same results. With their usual careful habits of observation, they soon found that a grass which they had for many years noticed in the same localities on their lands was no other than sugar cane in the early stages of its existence. The plant is not hard to please, it does not select a bed of rich soil to throw out its delicate roots. It is hardly ever found in places where there is a deposit of watery sediment. In the sandy walks of the garden, in the midst of the gravel of the esplanade surrounding a piece of water, or even among the mossy fragments of some old walls, the keen eye of the two planters found them out.

"This is certainly a fact of considerable importance, and we are glad of it for the sake of the country. We have the utmost confidence in the improvement of species by the mysterious and spontaneous action of nature, aided by the resources of science. We have long been deploring the indifference, attributable undoubtedly to incredulity, of our countrymen, and have not ceased to exhort them to obtain cane seed from Barbados, and endeavour to develop new species here. We can now do better than that. We have canes on our own soil, already accustomed to our climate, which will possess all the resisting powers and the *home-habit* of plants and animals that are autochthonous."

NEW PROCESS FOR DETERMINING THE MINERAL MATTER IN SUGARS BY MEANS OF BENZOIC ACID.

By Mr. E. Boyer.

The direct incineration of sugars for determining the inorganic matter is a long and delicate operation, for which there has been substituted in industrial analysis the empirical procedure indicated by Scheibler, which consists in incinerating a known weight of sugar in presence of pure concentrated sulphuric acid until a perfectly white ash is obtained. It is generally assumed that if we deduct the tenth of the weight of the sulphated ash the figure remaining will represent the weight of the mineral matter. Several chemists, especially MM. Aimé Girard and Violette, hold that this correction is insufficient, the ash of sugar consisting chiefly of alkaline carbonates and chlorides,

and they propose to deduct 2-10ths of the gross weight in order to obtain the real mineral matter of sugars.

We see, in fact, by a calculation of the equivalents that this latter correction approaches the reality.

The process which the subject of this paper embraces has the advantage of dispensing with any correction, since it gives directly the mineral matter of sugar in its natural state. It consists in effecting the carbonisation of the sugar in presence of a volatile acid, benzoic acid. To facilitate the mixture of this acid with the sugar it is preferably employed in solution, and as it is but sparingly soluble in water, alcohol at 90 per cent. is used as solvent, 100 c.c. to 25 grms. benzoic acid.

Into a platinum capsule 5 grms. are weighed, which are moistened with 1 c.c. distilled water; the capsule is gently heated over a Bunsen burner so as to caramelise the sugar without charring it, so that all the carbon may be ultimately formed in presence of benzoic acid. The addition of water renders this manipulation easy. He then adds 2 c.c. of the alcoholic benzoic solution, say 0·5 grm. of the acid, and evaporates on the sand-bath, heating at first gently until the alcohol is entirely driven off, and then raising the heat to effect the carbonisation.

The decomposing benzoic acid gives off abundant vapours, which swell up the sugary matter, especially if we take the precaution of giving the capsule a rotatory movement. The heating is continued until all the benzoic acid is volatilised.

The carbon obtained is bulky and of a brilliant black. To effect the combustion the capsule is put at the entrance of a muffle furnace heated to dull redness. The incineration is complete in half-an-hour, and the ash obtained is white and bulky.

The capsule is weighed rapidly after cooling in order to avoid the absorption of moisture by the alkaline carbonates.

The weight obtained represents the mineral matter in 5 grms. sugar. Ammonium benzoate may be used instead of benzoic acid, but whichever is taken we must first ascertain that it leaves no residue in the conditions of the analysis.

The results given by this method agree with one another, and justify the deduction of 2-10ths from the weight of the sulphated ash to obtain the real mineral matters of sugars of the first and second quality. Subjoined are some determinations compared with the

results of the sulphuric determinations corrected by the successive deduction of 1-10th and 2-10ths :—

Kind of Sugar.	Benzoic Incineration.	Sulphuric incineration. Un-corrected.	1-10th correct.	2-10ths correct.
Blank experiment....	0·06	0·08	0·07	0·06
First quality	0·73	0·90	0·81	0·72
Second ,, ...	0·94	1·18	1·06	0·94
Mixture	1·81	2·25	2·03	1·80

—*Comptes Rendus.*

HOLLAND.

In consequence of the revenue from the Sugar Duties for the current year falling below the calculations made for the budget, the Finance Minister has made a proposition that the deficit shall be shared among the manufacturers of raw sugar. The revenue for the last four years has been, in round numbers :—

	£.
1886	666,000
1887	707,000
1888	684,000
1889	715,800

The duty is levied according to the quantity and density of the juice. The extraordinary circumstances of the past year, which cannot be regarded as normal, have completely upset all the calculations of Ministers, manufacturers, and refiners.

An Amsterdam correspondent of the *Deutsche Zuckerindustrie* remarks that the immediate effect of the propositions of the Finance Minister would be that the manufacturers would be punished for having worked up more beets than in former years, the excess having been owing to an extraordinarily abundant crop, and they would also have to suffer for having increased the working power of their factories. They certainly expected to make a larger profit, but they had to work more and for a longer period, and had to pay higher prices to the agriculturists for the beets they required. The enormous advance in prices of raw sugar had the effect of compelling the refiners to practically suspend operations, hence the manufacturers have been unable to get the allowance of duty made to them on delivery of sugar to refiners.

BELGIUM.

Production and Consumption of Sugar.

At a meeting of the Central Society of Agriculture, in Belgium, the following remarks were made by a member relative to the statistics of the Belgian sugar production :—

"In round figures our total exports of raw and refined sugars exceed the imports, taking the mean figures for three past years, by 118,000,000 kilos. Our total production for the 35,000 hectares under beet cultivation may be taken at an average of 40,000 kilos. per hectare, or 1,200,000,000 kilos. of beets.

This mass of beets with a yield of 15% at 88°, *with* (be it understood) the *excédents* of the legal yield, gives us in raw sugar 201,000,000 kilos., from which, if our exports exceed the imports by 118,000,000 kilos., it appears that our general consumption would be 93,000,000 kilos. of raw sugar.

But for fear of being charged with exaggeration, I will reduce this figure by a full third, and I will boldly put our consumption at 60,000,000 kilos., that is at 10 kilos. (22 lbs.) per head for our 6,000,000 souls.

If it is a fact, and Mr. Gladstone affirms that it is, that the consumption, or rather the industrial use of sugar in England has now reached 38 kilos. (83 lbs.) per head, one would like to know the cause of this enormous difference between two countries which are tolerably well to do.

This difference arises entirely from the abolition in England of all duties and taxes on sugar, where it is not looked upon as an article of luxury, but as an industrial substance of the first importance.

I am convinced that if we could some day abolish at a stroke our excise, and the *enormous premiums* resulting from our legislation, in a few years our consumption, the use of sugar here would attain the English pitch, and in place of the 60,000 kilos. of our present consumption, we should reach the figure of 228,000,000 kilos. annually of sugar for industrial purposes."

RESULTS OF THE 1889 CROP on the Plantations of the McCall Bros. Planting and Manufacturing Co., Limited, Louisiana.

That enterprising journal, *The Louisiana Planter*, has signalised the completion of its second year by publishing in full in its issue of June 28th the very carefully compiled report of the chemist having the control of the "grand circle of sugar houses" belonging to Messrs. McCall Bros., comprising the plantations of Evan Hall, Belle Alliance, Souvenir, New Hope, Belle Terre, and Palo Alto. For all details we must refer our readers to *The Louisiana Planter*, as the report is far too long for our columns. We have thought, however, that the summarised results might be advantageously compared with those stated in the Report of Calumet Plantation, which we have given at tolerable length in last month's *Sugar Cane*. These results are as follows:—

GENERAL STATEMENT OF THE RESULTS OBTAINED ON THE DIFFERENT PLANTATIONS.

Field Results.

For the plantations on which the weight of the plant and stubble were kept separate, the results per acre are as follows:—

Plant Cane.

	Tons.
Evan Hall	21·32
Belle Alliance	19·15
Souvenir	13·52
Palo Alto	24·45

Stubble Cane.

	Tons.
Evan Hall	22·80
Belle Alliance	18·25
Souvenir	17·05
Palo Alto	22·05

General average plant and stubble irrespective of comparative area of each crop:—

	Tons.
Evan Hall	21·97
Belle Alliance	18·80
Souvenir	16·21

	Tons.
New Hope	19·99
Ascension	17·79
Cane ground in New Hope sugar house	18·87
Belle Terre	17·70
Peytavin and Dugas	15·30
Crescent	15·92
Rodriguez	14·40
Cane ground in Belle Terre sugar house	15·92
Palo Alto	23·30

SUGAR HOUSE RESULTS.

Cane Ground.

	Acres.	Tons.
Evan Hall	1,041	22,873
Belle Alliance	1,059	19,913
Souvenir	396	6,483
New Hope	880	16,608
Belle Terre	1,200	19,102
Palo Alto	554	12,903

Juice Extracted.

	Gallons.	Pounds.
Evan Hall	3,976,000	35,313,887
Belle Alliance	3,407,931	30,257,166
Souvenir	1,116,530	9,889,797
New Hope	2,674,908	23,763,732
Belle Terre	3,145,815	28,120,144
Palo Alto	2,105,215	18,641,533

Syrup Made.

	Gallons.	Pounds.
Evan Hall	896,401	9,270,391
Belle Alliance	802,812	8,341,731
Souvenir	257,764	2,699,372
New Hope	753,998	7,650,013
Belle Terre	796,451	8,262,594
Palo Alto	478,987	5,053,286

First Masse Cuite Made.

	Cubic Feet.	Pounds.
Evan Hall	52,101	4,778,148
Belle Alliance	49,734	4,607,244
Souvenir	15,934	1,482,811

	Cubic Feet.	Pounds.
New Hope	42,758	3,956,954
Belle Terre	46,527	4,327,011
Palo Alto	32,202	3,018,448

Dry Sugar Made.

	Pounds.
Evan Hall first granulated	32,234
Evan Hall soft white	32,854
Evan Hall first yellow clarified	2,578,503
Evan Hall seconds	616,939
Evan Hall thirds	57,224
Evan Hall total sugars	3,317,754

	Pounds.
Belle Alliance first soft white	19,488
Belle Alliance first yellow clarified	2,522,434
Belle Alliance seconds	682,864
Belle Alliance thirds	21,000
Belle Alliance total sugar	3,945,786

	Pounds.
Souvenir first soft white	20,854
Souvenir first yellow clarified	765,625
Souvenir seconds	210,070
Souvenir thirds	7,500
Souvenir total sugar	1,004,049

	Pounds.
New Hope first soft white	469,770
New Hope first yellow clarified	1,474,849
New Hope seconds	624,281
New Hope total sugar	2,568,900

	Pounds.
Bell Terre first soft white	1,013,672
Belle Terre first yellow clarified	1,259,721
Belle Terre seconds	654,659
Belle Terre thirds	212,671
Belle Terre total sugar	3,140,723

	Pounds.
Palo Alto first soft white	1,348,637
Palo Alto seconds	467,242
Palo Alto thirds	58,412
Palo Alto total sugar	1,874,291

Commercial Molasses.

	Gallons.	Pounds.
Evan Hall	141,436	1,672,268
Belle Alliance	131,250	1,496,250
Souvenir	44,654	526,489
New Hope	104,750	1,244,850
Belle Terre	116,871	1,375,585
Palo Alto	80,200	939,355

Commercial Masse Cuite.

	Pounds.
Evan Hall	4,990,022
Belle Alliance	4,742,036
Souvenir	1,530,538
New Hope	3,813,750
Belle Terre	4,516,308
Palo Alto	2,813,646

GENERAL PROPORTIONAL RESULTS.

Mill Extraction.

	Per cent.
Evan Hall	77·19
Belle Alliance	75·98
Souvenir	76·32
New Hope	71·54
Belle Terre	73.59
Palo Alto	72·24

Sucrose in the Mill Juice.

	Per cent.
Evan Hall	12·46
Belle Alliance	12·94
Souvenir	12·68
New Hope	13·23
Belle Terre	14·27
Palo Alto	12·37

Sucrose in the Different Sugars.

	Gran.	Soft White.	Yellow Clarified.	Total First Sugars.	Seconds.	Thirds.	Total. Sugars.
Evan Hall	99·70	99·20	97·24	97·30	92·51	86·90	96·23
Belle Alliance	—	99·00	97·80	97·81	90·86	87·00	96·28
Souvenir	—	98·50	97·80	97·82	93·10	89·15	96·76
New Hope	—	98·84	98·41	98·51	95·21	—	97·16
Belle Terre	—	97·82	97·27	97·42	92·53	90·41	95·93
Palo Alto	—	99·24	—	99·24	89·90	92·30	96·64

Results per Ton and per Acre.

	Sugar.		Molasses.		Commercial Masse Cuite.	
	Ton.	Acre.	Ton.	Acre.	Ton.	Acre.
Evan Hall	145·05	3,187	73·11	1,606	218·16	4,793
Belle Alliance..	163	3,065	75·14	1,413	238·14	4,478
Souvenir	154·87	2,535	81·21	1,329	236·08	3,864
New Hope	154·68	2,918	79·95	1,415	229·63	4,333
Belle Terre	164·42	2,617	72·07	1,147	236·49	3,764
Palo Alto......	145·26	3,384	72·8	1,696	218·06	5,080

Per cent. of the time actually required to take off the crops, which was unnecessarily lost, amounted to:—

	Per cent.
On Evan Hall	11·73
On Belle Alliance	—
On Souvenir	39·17
On New Hope	28·13
On Belle Terre	23·00
On Palo Alto	21·00

Per cent. of the sucrose contained in the cane, sucrose lost in bagasse amounted to per cent. of that in the cane:—

	Per cent.
On Evan Hall	12·48
On Belle Alliance	15·60
On Souvenir	15·16
On New Hope	20·57
On Belle Terre	18·23
On Palo Alto	19·67

Losses by inversion per cent. of the sucrose contained in the mill juice:—

	Per cent.
On Evan Hall	·90
On Belle Alliance	1·66
On Souvenir	5·05
On New Hope	5·41
On Belle Terre	4·49
On Palo Alto	5·08

The losses of manufacture, other than by inversion, and per cent. of the sucrose in the mill juice are:—

	Per cent.
On Evan Hall	16·40
On Belle Alliance	11·45

	Per Cent.
On Souvenir	5·05
On New Hope	5·17
On Relle Terre	9·44
On Palo Alto	5·50

After deducting all losses of manufacture and inversion from the sucrose in the mill juice, the sucrose recorded in the firsts, seconds, and thirds, and the molasses of commerce representing 100 parts, the following proportional division can be made:—

	In the First Sugar.	In the Second and Third Sugars.	In the Molasses.
On Evan Hall	64·42	24·43	11·15
On Belle Alliance	72·87	16·47	10·66
On Souvenir	68·81	17·16	14·03
On New Hope	68·39	19·66	11·95
On Belle Terre	64·25	22·14	13·51
On Palo Alto	63·92	23·87	12·21

With the exception of Palo Alto, where there was too much water used in washing the first sugars, the above figures show that the best results in first sugar boiling were obtained at Belle Alliance.

This is believed to have been entirely the result of stiff boiling.

This shows that, as compared with Belle Alliance, on the other places the operation of making first sugar had the following degrees of inferiority:—

	Per cent.
Evan Hall	11·60
Souvenir	5·57
New Hope	6·16
Belle Terre	11·83
Palo Alto	12·28

The total sucrose accounted for in all the different grades of sugar is as follows:—

	Per cent.
Evan Hall	88·85
Belle Alliance	89·34
Souvenir	85·97
New Hope	88·05
Belle Terre	16·39
Palo Alto	87·79

The shortages in the sucrose accounted for in the total sugars accordingly are:—

	Per cent.
For Evan Hall	0·55
For Souvenir	3·78
For New Hope	1·44
For Belle Terre	3·32
For Palo Alto	1·74

On Evan Hall and New Hope the shortage is believed to have been entirely due to want of stiffness in boiling, for owing to the large capacity of the hot rooms the errors in the boiling of the first products were in a measure rectified in the boiling of the second sugars. Had not a certain quantity of third sugars been made at Evan Hall its shortage would undoubtedly have been greater. On Souvenir, Belle Terre, and Palo Alto the shortage in total sugars is principally due to the want of sufficient capacity in the hot rooms. If the percentage of juice extracted on each place had been the same as that on Evan Hall, the various coefficients of loss the same as the lowest noted in the foregoing pages, and the sucrose recovered in the sugars in every instance the same as at Belle Alliance, the yields per ton of cane for each of the places would have been as follows:—

	Pounds.
For Evan Hall	169·80
For Belle Alliance	177·80
For Souvenir	173·80
For New Hope	180·38
For Belle Terre	215·52
For Palo Alto	169·36

This proves that with such sugars as were made, the different plantations show the following shortages in their resutls:—

	Per cent.
Evan Hall	14·58
Belle Alliance	8·32
Souvenir	10·69
New Hope	14·25
Belle Terre	23·71
Palo Alto	14·24

DIFFUSION OF SUGAR CANE, COMPARED WITH DOUBLE CRUSHING IN MILLS.

By NEVILE LUBBOCK.

(From "Timehri.")

Any modification of the present process of cane sugar manufacture or any new process which promises to reduce the cost of production, requires the most careful consideration on the part of planters. Competition, especially when aided by enormous subsidies, as is the case with that which cane sugar producers have to meet, will inevitably leave those behind who do not adopt the most economical means of production. While, however, sugar producers will be wise to adopt any new process which tends to economy, it behoves them to investigate any such new process to the fullest extent, and to satisfy themselves before adopting it that it will in reality conduce to the end sought, and that its promises will not fail to be fulfilled upon its practical adoption.

It is well known that under the system which generally prevails, the quantity of cane juice obtained is considerably below that which actually exists in the sugar cane.

It may be assumed that the sugar cane contains about 87 per cent. of its weight in cane juice. Where single mills are used the expression of juice during a crop rarely exceeds 66 per cent. of the weight of the cane. In the case of double crushing about 72 to 74 per cent. of juice is obtained.

Whether the existing type of mills, at any rate those in general use in British Guiana, is incapable of improvement may possibly be doubtful; the result of the De Mornay mill seems to show that the abolition of the trash turner would be attended with decided advantage.

Up to the present, however, it has not been found possible to extract more than 72 to 74 parts of juice from 100 of cane by means of mills.

It is contended that an extraction from the cane equivalent to 85 per cent. of juice can be obtained by means of diffusion.

It may be remarked, however, that in the report on the manufacture of sugar by diffusion at Magnolia estate in Louisiana, during the season 1888-9, by G. I. Spencer, the returns show that with canes containing 88·9 per cent. of normal juice, the extraction amounted to

83·3 per cent. only. In Demerara, taking a crop through, canes probably do not contain more than 87 per cent. of normal juice; and assuming the extraction by diffusion to be proportionate to the quantity of juice contained in the cane, the extraction would be reduced below 82 per cent. The canes operated upon at Magnolia were plant canes, which accounts for the high percentage of juice.

The difference, however, between one extraction of 72 per cent., and one of 82 per cent., is obviously very appreciable. A gain of 10 parts on 72 is equivalent to nearly 14 per cent. It would, therefore, appear at first sight, that diffusion ought to be far more profitable than double crushing.

Whether this is really the case, however, obviously depends partly upon the question of the relative cost of the two processes. If the increased cost of diffusion is equal to or greater than the increased gain, there will be no economy in introducing it. Let us endeavour to estimate the increased cost of diffusion as compared with double crushing.

We must consider two cases, one in which a double crushing plant is already in existence, the other in which no plant exists.

In the first case we will assume that the plant is complete but only sufficient for the manufacture of sugar from the juice obtained. If we assume that the cost of crushing the exhausted chips of cane is equal to the cost of crushing the original cane, and that the exhausted chips are double-crushed, the comparison is much simplified. It is perhaps doubtful whether this is so or not, but probably the difference will not be great either way, and in the absence of sufficient experience it seems at present the safest course to assume that the cost of the one is equal to the cost of the other.

In the case of diffusion we have (1) the cost of the plant, (2) the increased cost of working it, (3) the cost of increased quantity of fuel due:

(*a*) to the increased evaporation,

(*b*) to the diminished value of the megass as fuel,

(4) the cost of packages for the increased quantity of produce, (5) the cost of drogherage of the increased produce to ship-board, to set against the increased quantity of sugar.

We may, perhaps, add the loss which might arise from an increased liability to stopages arising from mishaps. Any such stoppages are as a rule costly both in labour and fuel. It is, however, too soon to calculate the value to be attached to this. The difficulties attending the starting of a new process and getting the hands well acquainted

with the work required of them, are always considerable, and it would not be fair to assume that because stoppages of various kinds have frequently arisen in factories where diffusion has been tried, they may not with more experience be got rid of altogether.

If we take the case of a factory making 2,000 tons of all sugars at present with double crushing, it seems possible to estimate roughly what the value of the increased sugar would be, and what would be the cost of obtaining it.

We have already stated that it is claimed that the diffusion juice obtained from the cane is equivalent to an extraction of 85 per cent. of original juice. It may, perhaps, be open to doubt whether the methods of analysis and calculation by means of which the result of 85 per cent. is obtained, are absolutely reliable. A very slight inversion in the sugar contained in the exhausted chips would lead to very erroneous conclusions if polariscopic indications of the cane sugar contained in such juice are taken as the indication of the extraction. We think, therefore, that an expression of 82 per cent., in view of the Magnolia results, is as high as it is at present safe to calculate upon.

Taking as our basis of comparison an extraction of 82 per cent. for diffusion against 72 per cent. for double crushing, we have a gain in quantity of 14 per cent. of sugar, this on a crop of 2,000 tons of all sugars represents 280 tons of sugar with its proportionate quantity of molasses or rum. A fair valuation of 1 ton of sugar with its offal would be about £15, and 280 tons at £15 will amount to £4,200.

The cost of the necessary diffusion plant may be taken at about £16,000, and the interest and wear and tear of this we will assume at 10 per cent., or £1,600 per annum.

The next item of expense will be the cost of the extra fuel required. In the case of double crushing the megass obtained forms a valuable fuel, and with the assistance of about 5 cwts. of coal per ton of sugar, is sufficient for the manufacture of the sugar and rum produced. It seems at present doubtful whether the exhausted chips even when double-crushed are of any value as fuel. This is, however, rather a difficult question. At Aska and we believe in Java the exhausted chips have been spread in the sun to dry and subsequently utilised as fuel; the amount of labour required for this purpose is very considerable, and puts entirely out of the question this method of dealing with the chips in British Guiana. In this colony they are passed through a mill, or even double-crushed, and are no doubt after such treatment

available as fuel, and theoretically of considerable value for this purpose. There is, however, much greater difficulty in burning cane refuse in this finely comminuted condition than in the case of either single or double-crushed megass. The particles being small fall readily through ordinary grate bars, and they lie packed so closely together that the free passage of the air required for combustion is impeded. Hence if their theoretical value as fuel is to be made available, some special arrangement of furnace will have to be adopted. We do not doubt that this will be done, as there does not appear to be any greater inherent difficulty in rendering these chips available as fuel than in the case of sawdust. If we assume that their theoretical value can be utilised, let us try to estimate this, and compare it with the fuel value of megass from mills with an extraction of 72 per cent. With such an extraction every 100lbs. of cane yields 28lbs. of megass, this megass contains 13lbs. of woody fibre and about 2·6lbs. of sugar. The woody fibre and sugar together contain about 7·65lbs. of carbon. With diffusion the sugar in the megass practically disappears altogether, and we have the 13lbs. of woody fibre per 100lbs. canes containing 6½lbs. of carbon. Thus assuming the quantity of water per lb. of carbon is the same in double-crushed megass and double-crushed chips, the value of the fuel in the two cases will be as 7·65 is to 6·50, or as 100 is to 85 nearly, per 100 lbs. canes.

It will be more convenient, however, for our purpose, if we compare the value of these chips with that of double-crushed megass per ton of sugar made.

In the case of double crushing, 11 tons of canes will give 1 ton of sugar in British Guiana and these 11 tons of canes will give 3·08 tons of megass: 4·4 tons of such megass are equivalent to 1 ton of coal (I assume that 1lb. of such megass will evaporate 1·36lbs. of water, 1lb. of coal evaporates 6lbs.); 3·08 tons are therefore equivalent to 15·4 cwts.

Assuming that with diffusion we should obtain 14 per cent. more sugar, 9·6 tons of canes will produce 1 ton of sugar, and if we assume that the canes contain 13 per cent. of woody fibre, and that the double-crushed chips contain 50 per cent. of water, these 9·6 tons of canes will produce 1·87 tons of megass or double-crushed chips. These chips, if the percentage of water is the same as that in double-crushed megass, should be as valuable as fuel lb. for lb.; taking, therefore, 4·4 tons of such megass as equivalent to 1 ton of coals, 1·87 tons are equivalent to 8·27 cwts.

Let us turn now to the increased evaporation required in the case of diffusion, per ton of sugar; but we may remark in passing that in addition to this, the water of diffusion has to be kept hot during the whole time diffusion is going on, and that this must involve a continued loss by radiation or otherwise, thus necessitating an expenditure of fuel over and above what would be required for evaporation and cleaning alone. A ton of sugar with fairly good juice can be obtained from 1,700 gallons. With a dilution of 30 per cent. 2,210 gallons would be required or an addition of 510 gallons of water. Assuming that 1lb. of coal will evaporate 12lbs. of water, we shall require 425lbs. of coal or 3·77 cwts. per ton of sugar to bring the juice to its normal density. We have already seen that the theoretical loss in the value of fuel per ton of sugar amounts to 15·4 — 8·27 = 7·13 cwts.
adding to this the .. .. 3·77 ,,
we have a total quantity of 10·90 cwts. or say, 11 cwts. per ton of sugar, over and above, what is now required. We may fairly value this 11 cwts. at present at 19/-.

It will be remarked that allowing 5 cwts. of coal per ton of sugar, with double crushing and estimating the megass as equivalent to 15 cwts. per ton of sugar, the equivalent of one ton of coal is consumed per ton of sugar made including its proportion of rum. In the case of diffusion the calculation allows an equivalent of 23·77 cwts.

Most practical planters in British Guiana will be disposed, we believe, to think that the value of diffused chips as fuel is much over-estimated in the foregoing calculation; and we freely admit that, at any rate in the Western Hemisphere, the value of diffused chips as fuel has not been demonstrated; and that, according to public report, the quantity of coal actually consumed, where diffusion has been practically carried out, has been largely in excess of the quantity set down.

The increased cost of labour is the next item. The cost of labour for manufacture in the buildings is usually about $3 per ton of sugar made. We believe that $4·50 per ton made is a fair estimate of the cost with diffusion. This is an increase of $1·50 or 6/3 per ton of sugar.

We have lastly the cost of packages for the increased quantity of sugar made, which we may put at 14/- per ton of sugar including the rum puncheons—if no rum is made the cost would be higher—and drogherage to ship which varies considerably on different estates, probably $2 or 8/4 per ton is a fair average figure.

Summing up we have have value of increased product			£4,200
Less:			
Interest and wear and tear	£1,600		
Fuel, 2,280 tons sugar at 19/- per ton	2,166		
Extra labour, 2,280 tons at 6/3 per ton	712	10s.	
Packages, 280 tons at 14/- per ton	196		
Drogherage, 280 tons at 8/4 per ton	116	10s.	
			4,791
Loss......................			£591

If these figures are fairly correct, there does not appear to be any advantage in adopting diffusion on estates where a satisfactory double crushing plant already exists.

In the case where no plant exists, diffusion would compare rather more favourably, as the required machinery could be somewhat more cheaply erected than in the case where it must be in the form of additional machinery. The difference, however, would not be very appreciable. Moreover, the fact that a larger capital must be locked up in a diffusion plant than in a double-crushing plant, would deter most people from adopting diffusion, even though the increased profit left a fair rate of interest on the extra capital employed. So long as bounties are allowed to continue, cane sugar production must be looked upon as an extra hazardous industry, and a proportionate profit will be looked for before capital is embarked.

In the foregoing calculations we have endeavoured to make the comparison as fairly as possible between the two methods. We are well aware that those who are partisans of diffusion will think that the increased quantity of sugar which can be obtained is greater than that set down, they may also perhaps take a different view of the fuel question, as also that of labour. On the other hand, it is fair to point out that as much as 74 per cent. of juice has been obtained by double crushing, and that there is room for some diminution in the fuel with this process. We have endeavoured, however, to avoid taking extreme figures, and we believe that those set down are as close to what may be reasonably expected as the present state of our knowledge admits.

Further experience will, however, shortly be forthcoming, and prudence suggests that it would be wise to await this experience before embarking capital in diffusion.

THE SUGAR INDUSTRY IN PERU.

The great agricultural industry of Peru, and the one that the country appears best adapted to, is the growth of the sugar cane. The climate and soil appear to to be particularly suited to the cultivation of the cane. The cuttings require two years to come to maturity, and then the plants in the latitude of Lima may be cropped for three years in succession without renewal. In the sugar country in the north of Peru the cane roots are cropped for six successive years without being renewed. Another great advantage is in the equable climate, which enables the farmer to leave his cane standing until he is ready to grind it. There is never any fear of frost, and if the cane is maturing too rapidly he has only to keep off the supply of water, when the progress of ripening is instantly suspended until it suits the convenience of the farmer to have it proceed. Labour also is cheap; from 1s. 8d. to 2s. a day is paid, the labourers boarding themselves. Formerly the labourers were coolies and slaves; they were brought here in great numbers from China, but the emancipation of slaves in 1874 put an end to slave labour, and since then the coolies have been scattered throughout Peru, and have engaged in all kinds of work. The maximum annual product of sugar in Peru has been as high as 100,000 tons, but for several years past the annual export has not exceeded 50,000 tons. In addition to this, about 20,000 tons are manufactured every year for home consumption. The principal sugar country is in the valleys of Lambayeque and Chicama, in the north of Peru, although there are several large plantations in the valleys of the Rimac. The smaller ones average from 1,000 to 1,200 acres. Many of them are fitted up with narrow gauge railroads, and they all have the improved machinery for making sugar. From the juice of the cane immense quantities of rum are manufactured, and this is used for fuel in small cooking-stoves, and also for illuminating purposes; but it is largely used by the natives in the mountainous regions as a beverage. This liquor is made in various degrees of strength, and as the cane is easily grown, the manufacture of rum is only limited by the demand. It is sold in Lima and the villages at about 6d. a quart.

CUBA.

Cost of Production at a Central Factory.

We have extracted from the *Revista de Agricultura* the following details of the cost of operations in a Central Factory at Sagua.

The amount of cane crushed during the season was 4,000,000 arrobas. From this was obtained:—

	Weight in arrobas.		Percentage on weight of massecuite.		Percentage on weight of cane.
5,400 hhds. of first sugar	324,000	..	66·67	..	8·10
1,900 hhds. (195 gallons) of first syrup	162,000	..	33·33	..	4·05
	486,000	..	100·00	..	....

Apportioning the expenses to each hhd. of sugar obtained, we have:—

	7 months of the dead season.		5 months' crop. Stoppages.		5 months' crop. Grinding.		Total per hhd.
Day labourers' wages	0·97	..	0·43	..	2·19	..	3·59
Workmen's wages and salaries	0·80	..	0·14	..	0·59	..	1·53
Other similar expenses	0·53	..	0·16	..	0·74	..	1·44
	$2·30	..	$0·74	..	$3·52	..	$6·56

Total cost per Hogshead of Sugar.

	$
Labourers' wages all the year	3·59
Wages and salaries	1·53
Sundry similar payments	1·44
Management ($2,500) •	0·46
Wood, 47 arrobas	1·38
Storehouse, timber, ironwork	0·50
Repairs, presents, and taxes	0·51
Carriage, waste $4–25, warehousing $1-15	5·40
Cane, 741 arr. × 4·205 sugar 31·16 × $0·68	21·19
Total cost of a hogshead of sugar	$36·00

Estimating the products according to the prices ruling during the season, we have:—

	$
60 sugar cent. qb° at 6rs. at the port	45·00
Difference, value of sacks	1·00
Syrup, first quality, at $12½ the 175 gallons at factory	4·68
Value of 1 hhd. of sugar	50·68
Cost of do. do.	36·00
Profit per hhd. of sugar	14·68
Profit on 5,400 hhds. of sugar—the production of this factory	$79,272·00

This calculation does not take into account the interest, &c., on capital, either sunk or floating.

The same journal gives details of the expenses of manufacture in another Central Factory at Matanzas; in this case also the interest on capital, and provision for depreciation and sinking fund, are not taken into account. In this factory:—

The expenses per hhd. of sugar in wages of labourers and workmen were	$6·23
The total cost of the production of one hhd. of sugar was	$11·86

In this case the cost of the cane is not included.

BEET SUGAR IN AMERICA.

At the meeting of the Louisiana Sugar Planters' Association, held on the 12th June, a paper was read by Professor B. B. Ross "On the cultivation of the Sugar Beet in the United States, and the manufacture of sugar therefrom, prepared by Professor Von Tresckow."

The *Sugar Bowl* makes the following excerpts from this essay:—

It would be a very great advantage for Louisiana planters, through acclimatization of the sugar beet, besides the cane, to work two crops every year in their sugar houses.

According to Dr. Stubbs there would be too many obstacles in the way to the realization of this idea, but such should not discourage any one from further experimenting in order to fully demonstrate and prove the success or failure of this important industry in our midst. In Europe it has taken many years to bring the beet industry to its

present great importance, and that only through science and perseverance which must surely be well known to all present.

Perhaps one reason for failure in Louisiana so far, lies in the fact that it may take several years to properly acclimatize the sugar beets, or to find out the most suitable season for growing them here. In these I do not hesitate to state that former experiments in Louisiana and some other States did not receive proper attention, nor were the experimenters familiar enough with their subject.

The soil in Louisiana, according to many analyses from various districts made by me during the last two years, I find very suitable for sugar beets. The experiment of growing sugar beets, which I made last year at Cinclare, carried out under the most unfavourable circumstances and on unfertilized soil, can not be considered a failure in the least degree. The beets reached a maximum of 13½ per cent. of sucrose. Afterward, in consequence of receiving no attention, during my absence in Europe, and coming to maturity by throwing new leaves and growing into seed, their sucrose contents quickly fell off. Special attention must be paid to the beets during the maturing period, which, however, is easily known by the leaves becoming yellow and flappy. Whenever this occurs the beets must at once be removed from the soil.

Spain, a country which till within a few years, was considered unsuitable for growing beets, is making rapid strides with great success, and that in the same localities where they grow cane.

In 1889 there were in Spain three beet factories in operation and this year eight more factories are being erected.

In Europe the expenses of cultivating sugar beets are about $50 per acre, and the revenue from an acre $73, leaving a net profit of $23 per acre to the farmer, but if he has an interest in the sugar factory, as is usually the case, his profits are considerably increased.

In the United States the profits have a better show, according to the reports from Watsonville, in California, where from the sale of the beets they amounted to from $35 to $43 per acre.

Beet culture has a decided advantage over cane in so far as capital is concerned. The beet seed costs only $2.50 per acre; the total crop is sold every year. A flood can only ruin one crop, and even then there may be made some other crop in such a year, still leaving the land ready for a full crop of beets the following year.

The pulp from the beet sugar factory amounts to from 30 to 40 per cent of the weight of the beets treated in the factory; the leaves and heads left in the field come to one-fifth or one-quarter of the total weight of the beets. These articles are not included in my figures of earnings, but are of great value to the beet grower as "cattle food."

The climate most suitable for beet culture was formerly believed to lie between the 47th and 54th deg. north latitude, but in recent years it has been found that both lines may be stretched, as proved by the success in Sweden, Spain, and Italy. The average temperature for beet growing is about 65 deg. Fahr. The most suitable weather, as found during many years of careful observation, is for the first period warm and moist, in order to produce quick germination of the seed, thereafter rainy weather to produce size; and during the ripening period warm and dry, in order to increase the sucrose contained.

The Chair stated that he had hoped to have a paper on the subject of sugar beets from Prof. Stubbs, but that gentleman had not found time to prepare one. He was with us, however, and could join in the discussion.

The Chair called on Mr. J. B. Wilkinson, Jr., to open the discussion. That gentleman said he knew very little about the subject practically, but told how enthusiastically the Nebraska people received the machinery for their beet factory, which is now being constructed, and thought that if it was a success that enthusiasm would extend all over the country.

Mr. E. W. Deming said that one season they planted 75 pounds of beet seed, in Kansas, furnished them by the Agricultural Department at Washington. They grew well for a while, but one night they were all cut down by web worms. Last year they did better and made fine sugar from beets, but they had a remarkable season. What they can do another season is uncertain. The soil is very sandy, and he fears the exceedingly dry and hot June, July and August they have; however, he hopes they will succeed.

The Chair said Mr. Deming's remarks brought out two points:—First, that other seasons may not be so favourable as the last, and secondly, the probability of attacks from web worms.

The Chair called on Prof. Stubbs, who said he regretted not having prepared a paper on the subject, as he wanted to offer some statistics, data, etc., which he had not at hand. At the last meeting he told all

he knew about beets in the South. There are two things essential to make beet growing successful in this country. The first is to get agriculturists to grow the beet, and the second to get capitalists to erect the factories. It is doubtful if beet can be cultivated profitably here, on account of high labour, and a great deal of hand labour is required, such as weeding, etc. This seems to be the only drawback with the industry in the North. If this can be overcome the beet sugar industry has come, and come to stay. In the South it is doubtful whether beets will succeed so well. His experiments are unfavourable. Received seeds of four varieties from Washington and planted carefully at the Baton Rouge Station with poor results, they giving about 4·2 to 5 per cent. of sucrose with 4 to 4·2 of fibre. Similar results were obtained at Kenner and Calhoun. Will plant beet seed at the Sugar Experiment Station and test them during the Spring, Summer and Fall. He is not encouraged at all, and feels no certainty in experimenting with beets here. In a very dry season they do well, but in a wet season they do nothing at all.

The Chair asked if they were not making beet sugar quite low down in Italy, to which the Professor answered yes, but he did not think they were succeeding very well. Below a certain latitude, about the Southern part of France in Europe, and Virginia and Kansas in America, beet cannot be cultivated profitably. There is no limit, though, to the northern boundary. The latitude might be overcome to a certain extent by the altitude, which is doubtless the case in Italy.

BRAZIL.

THE VARIETIES OF CANE CULTIVATED IN BAHIA.

A correspondent of the *Revista de Agricultura*, writing from Brazil, after referring to the subvention (granted by the Government to Haupt & Co.) of 6% for 25 years on the capital of 9,850,900,900 reis (about £1,000,000) for the establishment of Central Factories, which he thinks will have a certain amount of success—gives the following information respecting the varieties of cane cultivated in Bahia :—

"I will conclude by giving a detailed statement of the varieties of cane known here. The whole of these are not generally propagated, but the best of them are more or less localised on the plantations of the Instituto Bahiano de Agricultura, from which, owing to indifference, only one or another here and there has obtained them, without contributing to the general spread of their cultivation.

"The cane which is cultivated on the estates here is the Salangor, almost always in conjunction with the Rosa, an excellent variety with a large yield in sugar and very vigorous in dry seasons, and the Pinang, commonly known as Pená, a variety of the Salangor, which possesses all the most valuable properties, and contains, like the former, 18·75 per cent. of sugar. Formerly the magnificent Cayana was generally grown, and the results obtained with it on the plantations are remembered with pleasure, owing to its large yield and its splendid growth and luxuriant vegetation with numerous canes, its lasting properties, and especially its vigour. It is stated that after a number of years a certain disease appeared, affecting the centre or heart of the cane, and it ceased to be cultivated and became extinct. Probably this was in consequence of the defective method of cultivation and the degeneration of the seed canes, for, as I have already explained, they use here only the upper and tender portion of the shoot, almost always taken at hap-hazard from the worst and most neglected fields, as they neither trouble themselves about, nor attach any importance to the selection of the seed. In the plantings of this Institute it is cultivated and propagated, and its fine healthy condition confirms me in the idea that its extinction on the estates was owing solely to the causes indicated.

"It would be advisable to introduce into Cuba the following varieties, in order that after being properly studied and experimented on, the best and most suited to the circumstances of each locality might be perpetuated, viz., Bois-rouge, Polvo de oro, Tamarín, Cayana, Función, Dr. Caetano, Rosa, Salangor Palmeira, Tiambó, and Mapou-rouge, with the Salangor which you have already. I do not consider the Bambú de Ceará nor the Kavangeri equally suitable, the first because its outer portion is excessively hard for the mill and it further inevitably produces wounds on the hands of those who cut and handle it, and the second because, although it has some valuable qualities, it

labours under the defects of throwing out a vast quantity of buds, the cause of which may be the constant moisture arising from the water lodged in the straw with which it is covered, and which is not got rid of for a considerable time, the daily rains here being of long duration, lasting through several months of the winter. Another defect consists in its brittleness, in consequence of which it would suffer much from strong winds which are rather frequent in Cuba, let alone the cyclones, which would certainly not leave a plant standing."

VARIETIES OF CANE CULTIVATED IN BRAZIL.

Name.	Percentage of Crystallisable Sugar.
Bois-rouge	21·03
Polvo de oro	20·05
Tamarín	19·18
Cayana de Otaití	19·45
Kavangeri	19·16
Salangor	18·75
Función	18·23
Dr. Caetano	18·20
Bambú de Ceará	18·15
Rosa	18·15
Salangor palmeira	18·67
Tiambó	18·28
Mapou-rouge	18·40
Lusier	16·27
Amarilla de Java	15·73
Yellow and red striped	14·39
Imperial	14·39
Mapou-perlé	18·40
Pená (Pinang)	18·75
Reina	16·95
Amarilla del Japón	13·58
Dark with red leaves	13·27

NOTICES OF BOOKS.

Timehri: being the Journal of the Royal Agricultural and Commercial Society of British Guiana. June, 1890.

We have received the new number, being Part I. of Vol. IV. (New Series) of this valuable and interesting publication, which appears half-yearly. In connection with the subject to which our Journal is devoted, there are two papers of unusual interest. One of these, dealing as it does with a "burning question," that of Diffusion *v.* Crushing, we reproduce *in extenso* in the present issue, reserving any comments, which could at the best be only those of a comparative outsider, as we gladly welcome contributions from such a competent quarter to so important a discussion. We may, however, remark that the opinion we have frequently expressed that the last word has not been said on this question, is fully justified by the conclusions at which Mr. Nevile Lubbock arrives. One thing is certain, viz., that in view of the undoubted fact that beetroot sugar can be produced at an average price of about 12s. per cwt., and that the beet production is advancing with huge strides, our Colonial friends must do their utmost to get all the sugar they can out of the cane, whether by diffusion or double-crushing, at any rate by the best and most improved machinery and appliances they can afford.

The paper by Mr. Seaforth M. Bellairs, on "Defecation of Cane Juice by Electricity," is a timely contribution to the too scanty literature on a very tempting subject. We ourselves confess to have been always fascinated by the idea of the feasibility of the clearage of sugar by means of electricity. The instantaneous and complete reversal of all the previously existing conditions, the thoroughness of operation of this remarkable agent have always seemed to us (ignorant laymen as we are) to contain the elements of possible success. We shall endeavour to find room next month for extracts from this paper.

And now, to turn to the "Occasional Notes" of the Editor, we find a quotation from our June number, which gives us the opportunity of correcting the unfortunate typographical error, by which we stated that the attempts made at Kew to raise seedling plants from *the sugar cane seeds* brought to England in 1872 by Mr. Alfred Fryer were "successful." The Editor of *Timehri* has correctly surmised that this should have been "unsuccessful."

SUGAR CANE SEED.

Reprinted from the *European Mail*, August 20th, 1890.

Sir,—I have only just had an opportunity of reading a letter which appeared in the *Manchester Courier* * of the 5th inst., under the above heading, from Mr. W. H. Jones. In that letter, on data supplied by Professor Harrison, the question of the recent discovery of sugar cane seed is raised, and it is made to appear as if I had claimed credit for what was really not my due.

I am very reluctant to enter upon anything in the nature of a controversy with Professor Harrison or anyone else, but the matter and tenor of his remarks leave me no alternative. I shall be as brief as possible, but, in order to afford your readers an opportunity of judging for themselves, it will be necessary for me to enter somewhat fully into the circumstances, which I may observe, possess interest and importance far beyond the narrow personal limits assigned them by Professor Harrison.

The first published notice of the recent finding of seedling sugar canes at Barbados was given in the *Kew Bulletin* for December, 1888, p. 295. In this a letter from Professor Harrison is published, and the opinion expressed that "the statement made by him appears to prove in a perfectly natural and circumstantial manner that a few mature seeds may occasionally be produced by the sugar cane." The subject was followed up in the *Kew Bulletin* for October, 1889, p. 243, and credit given to Professor Harrison and Mr. Bovell for showing that "under certain circumstances it may be possible to raise sugar cane from seed, an occurrence, owing to its extreme rareness, about which there has been so much doubt that it had hitherto been thought impossible." On this account it is further recommended that "Messrs. Harrison and Bovell be encouraged to devote special attention to the subject of seedling canes, and especially in testing the richness in sugar of the various seedlings already established by them."

So far, what were believed to be seedling sugar canes had been raised at Barbados, but the actual seed had not been described or figured. Neither Professor Harrison nor Mr. Bovell claimed to be professed botanists, and it was not unnatural that scientific men

* This should be *Manchester Examiner and Times.*

required something more than the occurrence of what were called "seedling" canes to prove the existence of actual seeds. In order to place the matter beyond doubt, it was necessary to examine the spikelets of the cane, and find the mature seed *in situ*. It is well known that in some grasses, such as *Festuca* and others, bulblets are formed in the flowering panicle, and these give rise to young plants, which, by unbotanical observers, could easily be mistaken for true seedlings. There was just this element of doubt in regard to the Barbados seedlings. Were they really produced by seeds, or were they the produce of adventitious buds or spikelets? The information so far attainable did not settle the point. Botanists on this side naturally declined to accept the occurrence of seeds until they had been actually found in the spikelets, and until these seeds had been observed to give rise, in a normal manner, to plants of true sugar cane. Portions of the arrow (or flowering panicle) of the sugar canes, supposed to yield the seedlings, were in consequence sent at my request from Barbados for the purpose of settling this point. Some hundreds of spikelets were carefully examined, but it was only after a lengthened investigation that a few seeds were found at Kew in a perfect state. These were submitted for observation to those most competent to form an opinion respecting them. Some of the seeds were sown under suitable conditions, and the whole process of germination carefully watched. Ultimately, these observations were repeated over and over again during a period extending over several weeks, and at last the fact was fully proved by a series of microscopical preparations, which definitely settled the matter beyond doubt or question. Following this, I read a paper before the Linnean Society, on March 10, giving the circumstances attending the discovery by Messrs. Harrison and Bovell of seedling sugar canes at Barbados, and accompanied by a description and drawings of the seeds and of the process of germination as observed at Kew. Further, seedling canes were shown in different stages of growth, some received from Barbadoes direct and others raised in this country. If this paper had been published immediately it would have been seen at a glance that full credit had been given to Messrs. Harrison and Bovell for all they had done.

It is well known that a paper contributed to any of the learned societies remains the property of the society, and its publication cannot be anticipated until it is published in regular course in the

Society's "Journal" or "Transactions." I may, however, state at once that in my paper, read before a full meeting of the Linnean Society (quoting from my manuscript copy), I used the following words:—"During the last two years, owing to the very intelligent experiments carried on at the Botanical Station at Barbados, Messrs. Harrison and Bovell have shown very conclusively that certain varieties of the common sugar cane produce mature fruits," and, further, "the experiments at Barbadoes, confirmed by observations at Trinidad, Demerara, and latterly at Kew, have now very clearly proved that the varieties of sugar canes known as Purple Transparent and White Transparent periodically produce seed at Barbadoes, and that the Bourbon cane, known also as the Otaheite cane, may do so very sparingly. From seed of the former received from Barbados sugar cane plants have been successfully grown at Kew, and observations have been made which are embodied in this paper." There is here a clear and definite statement of facts, and if nothing more were on record this would at once show that no attempt had been made to take from Messrs. Harrison and Bovell any of the credit due to them in this matter.

Unfortunately, owing to press of other and earlier matter, my paper has not yet been published. The notices of it which appeared in the newspapers were necessarily very brief and incomplete. I wrote at the time to both Messrs. Harrison and Bovell in regard to these notices, and promised to send the full text of my paper as soon as possible. Within a few days, however, I exhibited specimens of sugar cane seeds and seedling canes before the Scientific Committee of the Royal Horticultural Society. A short account of this was widely circulated in the press and appeared, amongst other papers, in the *Sugar Cane*, *The Colonies and India*, and the *European Mail*. All these papers have a wide circulation in the West Indies, and the references to the Barbados experiments, necessarily brief, are as follows:—"At Barbados, several times during the last twenty years, and more recently by Messrs. Harrison and Bovell, self-sown seedlings of the sugar cane have been observed, &c. In fact, in every instance in which attention was drawn by me to the seedlings of sugar cane the names of Messrs. Harrison and Bovell were associated with them. It would be tedious to give every case in detail. I may add, however, that to afford as much publicity as possible to the Barbados experiments, at my request the editor of *Nature* reproduced (in Vol. 42,

pp. 258-259) the principal parts referring to seedling canes, of the report issued by Messrs. Harrison and Bovell for 1889. The report had, I believe, been sent by Mr. Jukes Browne.

I may further quote the following emphatic words, spoken by me at a meeting of the Royal Colonial Institute in June last:—"Recently, at Barbados, the discovery by Professor Harrison and Mr. Bovell of seedling canes possesses world-wide interest, and these investigators deserve great credit for what they have done. The results of their discovery have been keenly followed on this side, and confirmed by independent investigation." These words appeared in *The Colonies and India* of June 18, and are now incorporated in the recently-issued "Proceedings" of the Royal Colonial Institute, Vol. xxi., p. 358.

I believe I have sufficiently shown that, so far from ignoring Messrs. Harrison and Bovell in this matter, I have done all that was possible to make known their investigations and to draw public attention to them. If inaccurate reports of my paper have been circulated in the press there are clearly no grounds, as I have shown above, for connecting such reports with anything in that paper. When this is published, it will be seen exactly what I have said, and I shall be prepared to accept full responsibility for it. In the meantime the publication of this letter will, it is hoped, reassure Messrs. Harrison and Bovell that their claims have not been overlooked.

While saying this I may, however, point out that the weak point in their investigations was the absence of any definite statement in regard to the finding of the actual seed in the panicle of the sugar cane. There was also wanting a careful and accurate description of it suited to the requirements of botanical science. The only attempt at a description published by Messrs. Harrison and Bovell is contained in their report for the year 1889, p. 40. This report was received in this country on March 31st last, and it is to be accepted as their latest delivery on the subject. The description of the seed given in this report is as follows:—"The fertile seeds enclosed in the glumes are long and narrow, being from 3 to 4 millimetres in length, and from ·65 to ·70 millimetres in breadth, and terminate in a beard from 6 to 8 millimetres long." If anyone will take the trouble to draw a figure according to the particulars and measurements here given, it will be seen that this is a description, not of the seeds, but of the pistil of the flower. The measurements, so far as my observations go, will apply to neither the pistil nor the seed. The so-called beard (given as

twice the length of the seed) is evidently the plumose stigma, which, however, does not remain attached to the mature seed. If Messrs. Harrison and Bovell's claims depended alone on this description, I am afraid there is no scientific man who would accept it as at all adequate to prove the existence of ripe seeds in the sugar cane. In fact, as good, if not a better, idea of the fruit of the sugar cane was given by Descourtilz nearly 60 years ago, but this was felt to be quite insufficient to settle the point. There are, of course, collateral circumstances in regard to the Barbados experiments, but taking the description as it stands it would throw grave doubt on the fact whether Messrs. Harrison and Bovell had ever observed the actual seed, before germination, in the glumes of the sugar cane. It would probably be said that what they had seen was only the ovary and the plumose stigma. These it is well known, exist in nearly every one of the thousands of flowers produced by the sugar cane. On the other hand, the ripe seed is found only in one out of every 500 spikelets, even in those varieties supposed to be most fruitful.

I notice Professor Harrison complains that a letter he wrote me in 1888 (addressed officially) was published in the *Kew Bulletin*, Professor Harrison is evidently very hard to please. This letter, and what I wrote in 1889, first drew public attention in this country to the importance of the work in which he and Mr. Bovell were engaged. Further, I have good reason to believe, the prominence given in the *Kew Bulletin* to this work did more than Professor Harrison is evidently disposed to admit in obtaining for him promotion to the important post he now enjoys in British Guiana. I only wish, however, that Mr. Bovell, who has had the lion's share of the cultural work at Barbados, was equally successful in receiving a due recognition of his services.

Having cleared the ground of the purely personal matters, I would mention, before closing this letter, that the experiments at Barbados in regard to seedling canes have, in a great measure, been anticipated by investigations carried on at Java by Dr. Benecke. In a report published in 1889, at Samarang, Java, Dr. Benecke has given a very clear and exhaustive account of the whole matter, illustrated by excellent drawings and dissections. I am indebted to Professor van Eeden, of the Colonial Museum, Haarlem, for a copy of this report, which reached me on the 13th instant. The publication of the Java experiments will probably now claim precedence over all others with

which we are at present acquainted. A perusal of Dr. Benecke's report leaves no doubt that sugar cane seeds have been found in Java. The drawings given of the seeds and the process of germination agree very closely with those exhibited by me before the Linnean and Royal Societies before Dr. Benecke's report reached my hands. As a fact of general interest, it may be noted that simultaneous, but quite independent, investigations carried on, both in the East and West Indies, have established the fact that the sugar cane under certain circumstances produces mature seed, and that the seed has been now so fully described and figured that we know as much about it as we do about the seed of wheat, rice, or any other of the numerous and familiar grasses which yield so large a proportion of the food of man and animals.

I am, &c.,

Kew, August 16th. D. Morris.

Correspondence.

To the Editor of "The Sugar Cane."

One of my correspondents in Barbados writes me that the present crop of the island is expected to run up to 75 or even 80,000 hogsheads of sugar. He himself thought the latter figure would be reached. If 80,000 hogsheads are shipped the crop will be the largest ever reaped. The crop of the island has for some years past been gradually increasing in bulk. In the time of slavery the average crop probably did not exceed 25 to 30,000 hogsheads, but at that time the planter fed the labourer, or rather the labourer by his labour on the soil fed himself, and gathered in a sugar crop for his master. Now the food stuffs are grown in America, and thus more land is left for the cultivation of the cane. The increase of the crop of late years is undoubtedly due to Professor Harrison, the late colonial analytical chemist. His analysis of the soil and of the cane has enabled him to point out the kind of fertilising food required by the cane, and with the aid of Mr. John Bovell, the manager of the Dodd's reformatory, experiments have been made from his suggestions, which have resulted most favourably. I must not omit to mention that this correlation of the manure and the cane plant was also accompanied with improved machinery, and to both we owe the

improved prospects of the Island of Barbados. Some months ago I saw in a number of the *Pall Mall Gazette* a paragraph giving credit to Mr. Morris of the Kew Gardens for the discovery of seeds in the cane. As I considered the credit was due to Professor Harrison, I sent him a copy of the *Pall Mall Gazette*. He has replied as follows:—

"It may be of some interest to you to know on what very slender grounds the discovery of the fact of the cane seeding is attributed to Mr. Morris. Our experiments at Dodd's were being carried on for some time before there was talk of a botanical station there, and soon after Mr. Morris was transferred from Jamaica to Kew he addressed a circular letter to the West Indian Governments, in which he stated, as an acknowledged and universally accepted fact, that the sugar cane was incapable of producing seed, and that improvement in quality must be sought for in bud variation, this latter being an assertion of his own, without there being proof that such variations occurred in the plant. Our systematic experiments with cane seedlings commenced in January, 1888, and towards the end of March in that year, when we had seedlings three months old, Mr. Morris, in a paper on the West Indies read before the London Chamber of Commerce, again stated that canes could not produce seeds, and repeated his assertion as regards bud variation. On September the 17th, 1888, on behalf of Mr. Bovell and myself, I wrote to Mr. Morris calling his attention to the fact that in Barbados canes had long been known to produce fertile seeds, and shortly describing our own results, and asking for assistance in the way of advice from him. At the time we regarded the letter as a private one. Its receipt was not acknowledged, and it remained unanswered. To our annoyance we found that without obtaining permission, Mr. Morris published such portion of my letter as suited his purposes in the *Kew Bulletin* for December, 1888, and in it practically laid claim to the credit by his own erroneous statements of having caused our investigations.

"We received no assistance whatever from Mr. Morris even in the way of advice, of which, as a rule, he is most liberal, but later he addressed letters to the Colonial Office, calling attention to the subject, and asking that fertile seeds of the sugar cane should be sent to the Kew authorities. By the first mail in December we sent him a bottle of spikelets of the cane arrow containing seeds, seedlings, and germinating seeds. These he appears to have examined and described, and this may have given rise to the paragraphs in the newspapers.

From these facts you will doubtless perceive that far from Mr. Morris having discovered that the cane produced seeds he had, until December, 1888, by the weight of his authority rather prevented investigation into the subject than assisted in it. Possibly Mr. Morris claims to have merely discovered the true seeds amongst the spikelets we sent him. If so, he has merely repeated Mr. Bovell's observations made in December, 1888, and January, 1889."

Professor Harrison concludes his letter by giving me permission "to make any use of his letter I think fit."

It is not only possible but probable that the proprietors of cane sugar estates will, in the future, have cause to be grateful to Professor Harrison for the increased productive power obtained from canes raised from seed. The professor is now in full work in the colony of Demerara, where unhappily the yield per acre is not equal to the yield reaped on a Barbados estate. The inhabitants of Demerara are a progressive race, ready to adopt any new invention or process that promises good results, so that I have every confidence that, in a few years, the name of Professor Harrison will be esteemed and honoured in Demerara as widely as it is now in the little island of Barbados, which he has left for the larger field and larger salary of Demerara.

Yours, &c.,

W. H. JONES.

2, Vermont Road, Upper Norwood,
15th July, 1890.

P.S.—Since writing the foregoing my attention has been called to an article in *The Manchester Examiner and Times*, of Tuesday, the 29th July, headed "Sugar Cane Seed," in which Mr. D. Morris gets the entire credit of discovering that the cane can produe fertile seeds. This makes it all the more necessary to publish Professor Harrison's letter.

ERRATA.

In the letter from the above correspondent in our June issue, the following corrections were inadvertently omitted. Line 2, for "adopted" read "adapted"; line 19, for "by" read "on"; line 40, for "upon" read "by reason of."

(The above letter and corrections should have appeared in our August number.)

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. THOMPSON, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

9742. R. J. SMITH, Northfield. *An improved sugar sifter.* 24th June, 1890.

10331. A. LEFRANC, L. LEFRANC, and A. VIVIEN, London. *Improvements in and connected with the manufacture of sugar.* 3rd July, 1890.

10449. W. R. HUTTON, Patrick. *Improvements in saccharate of lime.* 5th July, 1890.

10461. J. SELLARS, Litchurch, Derby. *Improvements in centrifugal machines.* 7th July, 1890.

10626. W. EDGELL, Bristol. *An improved machine for use in weighing out quantities of crushed sugar, tea, and other substances.* 9th July, 1890.

10893. R. PEZILLAS, London. *Apparatus for drying sugar or like substances.* (Complete specification.) 12th July, 1890.

11056. G. W. KING, London. *Improvements in presses.* 15th July, 1890.

11473. J. DUNCAN, London. *Improvements in the treatment of molasses or syrup for the purpose of improving its flavour.* 22nd July, 1890.

11642. D. STEWART, Glasgow. *Improvements in separating saccharine juices, and in centrifugal apparatus therefor, and applicable for other analogous purposes.* 25th July, 1890.

11683. J. DUNCAN, London. *The treatment of sugar, beet, and other roots for the conservation and conservation and concentration or drying thereof.* 25th July, 1890.

11686. S. M. LILLIE, London. *Improvements in evaporating apparatus.* 25th July, 1890.

12097. J. SELWIG and B. LANGE, London. *Improvements in centrifugal machines for pulpy materials.* (Complete Specification.) 1st August, 1890.

ABRIDGMENTS.

8092. JOHN N. S. WILLIAMS, of Honolulu, Hawaiian Islands. *Improvements in sugar cane slicing machines.* May 23rd, 1890. The

cutting knives are mounted in separate "boxes," which are put in place from the interior of the revolving drum, and are, therefore, interchangeable and adjustable. The slices of cane pass through openings in said "boxes" and fall into discharge shutes in the interior of the drum.

11136. S. PITT, of Sutton, Surrey. (A communication from L. W. Tracy, of New York.) *Improvements in evaporators or apparatus for the treatment of cane juice.* 10th July, 1889. This apparatus consists in a series of evaporators, through which the cane juice is passed, and is evaporated in transit under a vacuum. The invention is designed to produce a simple, cheaper, and lighter apparatus than is usually employed. The channel pipes, for the discharging of the juice in spray, are so arranged as to prevent any lime or foreign matter being deposited thereon. The evaporators are preferably made oblong in horizontal section, and both ends of the evaporating chamber of one evaporator are connected with both heating chambers of the next evaporator; a suitable partition being placed in one of the heating chambers to insure the circulation of the vapour through the pipes connected therewith.

11350. R. C. and C. H. GARTON, of Southampton Wharf, Battersea, brewers, and W. H. LAWRENCE, of 22, St. Mary Axe, London, brewer's engineer. *Improvements in apparatus for evaporating, heating, or cooling liquids.* 15th July, 1889. Spirally corrugated tubes are arranged to stand vertically, and the liquor under treatment is caused to flow down them in a circuitous path, either inside or outside. Steam or other suitable heating or cooling medium is circulated on the reverse surface. Feed and outlet taps or hoppers are provided.

12021. A. CHAPMAN, of 17, York Street, Liverpool. *A process or method of extracting sugar from sugar cane or other sugar yielding substances, and apparatus for the purpose.* 29th July, 1889. The cane is disintegrated or made into pulp, and the juice is removed by water displacement. The vessels used are preferably tall and narrow, and the pulp therein is protected from disturbance when the water is let in, by means of perforated plates placed above.

12809. W. MAXWELL, of Djocdja, Java. *Improvements in multiple effect evaporating apparatus for evaporating or concentrating sugar juice and other liquids.* 14th August, 1889. In this apparatus the sugar juice or other liquid is treated under a pressure usually less than that

of the atmosphere, the heat being obtained from steam, which surrounds a number of tubes through which the juice or other liquid circulates. Each evaporator consists of three chambers, viz., an upper and a lower chamber and an intermediate tube chamber. The chief object of the invention appears to be, to dispense with the usual central circulating tube, and to substitute, therefor, one or more external circulating tubes, the external space created thereby being utilised as additional heating space. The vapour arising from the first evaporator acts as the heating medium to evaporate the juice in the second, and so on throughout the series, as is usual in multiple effect apparatus, the upper chamber of the last evaporator being connected with a condenser and air pump.

AMERICAN.

ABRIDGMENTS.

430976. M. SWENSON, Fort Scott, Kansas, assignor of one half to A. W. WALBURN, of same place. *Diffusion battery.* 24th June, 1890. According to this invention the heating fluid may be caused to flow through all the cells in series or through each cell independently.

431574. THOMAS GAUNT, Brooklyn, New York. *Evaporating apparatus.* 8th July, 1890. For "in transit" apparatus. The liquor under treatment is passed through a series of tubes, externally heated, and is caused to have a rotary motion as well as a longitudinal one, by means of stationary helices or screws placed in said tubes.

430058. E. A. DE LISLE, of Paris, France. (Assignor to the Société du Traitement des Quinquinas of same place.) *Vegetable black.* 15th July, 1890. According to this invention, the vegetable black is made from the residuum of powdered cinchona bark (from which the quinine has been extracted), by means of calcination and subsequent cooling by water, a little hydrochloric acid being added. Suitable apparatus is shown for carrying out the process.

GERMAN.

ABRIDGMENTS.

50955. G. ADANT, Brussels. (Addition to Patent No. 44660 of the 1st January, 1888.) *Improvements in centrifugals applicable to the manufacture of cube sugar.* 2nd June, 1889. In the principal patent the pipes for admitting the "cleare" were arranged radially in the upper part of the centrifugal drum. In this patent of addition they are replaced by means of pipes bent downwards, and the centre part of the centrifugal drum is of a conical instead of a cylindrical form,

in order to permit of the steam being distributed evenly over the surface of the sugar plates. Again the horizontal moulding plates of the principal patent are replaced by perpendicular plates provided with ribs.

50990. BÜTTNER and MEYER, Uerdingen on the Rhine. *Apparatus for automatically treating beetroot cuttings with milk of lime.* 28th May, 1889. By this apparatus lixiviated beetroot or sugar cane cuttings are automatically impregnated with milk of lime, the percentage of lime absorbed always remaining the same. The apparatus consists of a receiver with a spiral conveyor which is placed in an inclined position in a perforated trough, and dips down partly into the receiver containing the milk of lime. The cuttings are admitted to the spiral conveyor by means of a pipe in connection with same, and are there raised and turned, being at the same time impregnated with the milk of lime, which is kept in constant circulation by means of a fly-wheel. The surplus milk of lime runs out of the upper part of the worm through the discharge pipe back into the lime receiver.

51153. EUSTACE W. HOPKINS. *Evaporating apparatus.* 2nd March, 1889. A rotatable hollow spindle is separated by a partition into two parts, one serving for the conveyance of the steam into the worms and the other for the discharge of the condensation water. The worms are so arranged that they branch off from the former and extend into the conveyor destined for the discharge of the condensation water. The liquid to be evaporated is placed in a suitable vessel.

51495. CARL STEFFEN, Vienna. *Sugar casing apparatus.* 18th May, 1889. (Addition to Patent No. 46958, 17th July, 1888.) The boxes, mentioned in the principal patent, for receiving the sugar masse-cuite are replaced by sugar loaf moulds; with this exception, the apparatus of the principal patent remains the same.

50100. HANDELSGESELLSCHAFT DROST & SCHULZ, Breslau. *Process for the production of crystallised sugar in raw sugar manufactories by the aid of centrifugals, and improvements in the latter.* 15th November, 1888. Filtered raw beetroot juice serves as casing medium, which is boiled down in vacuum evaporating apparatus (at the specific gravity of about 1·325) so far that when applied at this stage of its concentration and temperature, it neither forms crystals nor becomes detached from the sugar to be cased. The sugar is warmed in order to further the centrifugalling of the casing medium. A pocket serv-

ing the purpose of syrup tester, and provided with a discharge opening, is fixed on the outside of the jacket of the centrifugal; this opening corresponds to the opening in the centrifugal jacket and can be opened or closed at will by being turned round. A funnel in connection with the same conveys the syrup run off from the packet back into the space inside the jacket.

50188. CARL STEFFEN, Vienna. *A lixiviating battery for sugar and sugar masse cuite.* 1st November, 1888. A central-cellular vessel is connected with several suction, or wash vessels in such a manner that the contents of its cells are emptied on to all the suction vessels is conducted back for the purpose of feeding the cells in the central vessel. For the purpose of distributing the contents of each separate cell evenly on to all wash vessels, a pipe provided with small partitions is fixed over a row of suction vessels.

50412. F. DEMMIN, Berlin. *Improvements in sugar centrifugals, whereby sugar masses are systematically cased.* 13th February, 1889. The principal part of the apparatus is a rotatable vessel consisting of a large number of narrow chambers formed by vertical partitions. These chambers are placed radially round a cock capable of moving in any direction, and are brought in succession into communication with the discharge openings of the centrifugal and with the delivery pipe for the casing syrup, so that the syrup discharged after one centrifugalling is again made use of when the next mass comes round in its turn for centrifugalling. A suitable hand wheel, tooth wheel, and tooth gearing are provided for turning the movable vessel, and thus effecting the transposition of the chambers. A steam jacket placed round the casing of the centrifugal serves to keep the syrup at a proper temperature. Double sieves with layers of filter material placed between are provided, which prevent the sugar crystals from being thrown out of the centrifugal when the sugar mass is not in good condition for working.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

January 1st to July 31st.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Germany	3,474,153	4,133,733	2,935,828	2,447,202
Holland	316,122	307,460	262,183	174,184
Belgium	470,048	559,820	326,838	306,175
France	108,216	854,040	94,169	526,337
British West Indies & Guiana	1,362,394	927,499	1,289,278	703,449
British East Indies	1,138,692	339,322	785,020	170,697
China and Hong Kong	20,250	....	17,350	....
Mauritius	168,128	116,591	178,467	74,193
Spanish West India Islands	46,400	....	41,890	....
Brazil	695,792	248,038	497,686	149,085
Java	879,795	833,712	860,042	600,840
Philippine Islands	362,110	135,964	235,066	72,926
Peru	322,184	395,941	271,017	264,564
Other Countries	497,887	184,072	436,029	130,386
Total of Raw Sugars	9,862,171	9,036,192	8,230,863	5,620,038
Molasses	277,701	434,606	103,269	139,035
Total Sugar and Molasses	....	....	13,788,935	10,580,525
Refined Sugars.				
Germany	2,682,348	3,075,333	2,774,657	2,484,865
Holland	786,899	1,095,895	815,446	910,371
Belgium	154,435	88,606	165,140	80,317
France	1,003,848	1,587,629	1,092,058	1,287,854
United States	9,019	67,231	8,438	57,025
Other Countries	597,964	1,268	599,064	1,020
Total of Refined	5,234,513	5,915,962	5,454,803	4,821,452

EXPORTS.—Refined Sugars.

	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Sweden and Norway	43,338	31,416	38,427	22,776
Denmark	62,028	83,991	50,895	51,446
Holland	52,195	52,061	43,483	36,749
Belgium	15,729	17,023	11,620	11,702
France	5,216	4,255	4,126	2,754
Portugal, Azores, & Madeira	34,692	53,459	28,901	35,514
Italy	49,961	54,100	43,810	36,617
Other Countries	76,715	142,427	69,647	108,068
Total of Exports	339,874	438,732	290,909	305,626

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of July, 1890, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1887, 1888, and 1889, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"LUMPS AND LOAVES."							"OTHER SORTS." Including Crushed Loaf, Granulated, Crystallized, &c.							TOTAL.						
	Monthly Average.				July	July	July	Monthly Average.				July	July	July	Monthly Average.				July	July	July
	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France	1363	1686	1888	3382	1777	2080	3290	5099	4855	3398	7958	1464	10528	6235	6462	6541	5286	11340	3241	12608	9525
Holland	3780	3267	3005	3263	5134	1100	4018	2483	2675	3074	4564	3062	2895	4946	6263	5942	6079	7827	8196	3995	8964
Germany & Austria	1347	1510	2964	2808	1572	2669	2421	10463	11729	17245	19159	12739	13094	20708	11810	13239	20209	21967	14311	15763	23129
Belgium	592	622	995	385	421	354	146	308	227	267	247	182	217	269	900	849	1262	632	603	571	415
United States	454	8	..	41	54	..	58	2804	157	98	440	452	22	492	3258	165	98	481	506	22	550
Russia	3	..	..	..	..	20	..	452	1959	4275	..	2947	2254	..	455	1959	4275	..	2947	2274	..
Other Countries	..	1	14	..	10	2702	..	15	2	10	9	10	2509	..	15	3	24	9	20.	5211	..
Total	7539	7094	8866	9879	8968	8925	9933	21624	21604	28367	32377	20856	31519	32650	29163	28698	37233	42256	29824	40444	42583

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

To August 16th, 1890 and 1889. In Thousands of Tons, to the nearest Thousand.

	STOCKS. 1890.	STOCKS. 1889.	DELIVERIES. 1890.	DELIVERIES. 1889.	IMPORTS. 1890.	IMPORTS. 1889.
London	31	54	166	202	149	225
Liverpool ..	55	64	177	192	147	162
Clyde......	23	22	141	151	135	161
Bristol	1	2	45	36	44	34
Total ..	110	142	529	581	475	582

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Circular.)

For the four principal Ports. In Thousands of Tons, to the nearest Thousand. For July, 1890 and 1889.

	STOCKS. July 1st. 1890.	STOCKS. July 1st. 1889.	DELIVERIES. In June. 1890.	DELIVERIES. In June. 1889.	IMPORTS. In June. 1890.	IMPORTS. In June. 1889.
New York	37	42	60	64	65	81
Boston	6	4	17	11	18	13
Philadelphia....	6	4	41	34	42	35
Baltimore	..	..	..	..	..	..
Total......	49	50	118	109	125	129
	Decrease ..	1	Increase ..	9	Decrease ..	4
Total for the year..........			776 —	693	813 —	711

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, August 14th, 1890.

Fair Refining.	96o/o Centfs.	Granu-lated.	Stand. A.	Stock in Four Ports.
Aug. 14, 1890.—5c.	5⅜c.	6⅛c.	5⅞c.	Jan. 1, 1890— 11,169 tons.
Aug. 15, 1889.—6¼c.	7 1-16c.	8¼c.	8c.	Jan. 1, 1889— 32,254 tons.
Aug. 16, 1888.—5 5-16c.	6¼c.	7½c.	7⅛-c.	Jan. 1, 1888— 47,798 tons.
Aug. 18, 1887.—4 9-16c.	5 5-16c.	5⅞ 15-16c.	5 9-16c.	Jan. 1, 1887—102,279 tons.
Aug. 19, 1886.—4 9-16c.	5 3-16c.	6 1-16c.	5 9-16-⅝c.	Jan. 1, 1886— 57,328 tons.
Aug. 20, 1885.—5¼c.	6c.	6 11-16c.	6¼-⅜c.	Jan. 1, 1885— 89,186 tons.
Aug. 14, 1884.—4⅞c.	5 11-16c.	6 9-16c.	6 1-16c.	Jan. 1, 1884— 60,900 tons.
Aug. 16, 1883.—6⅜c.	7 9-16c.	8 11-16c.	8 3-16c.	Jan. 1, 1883— 50,297 tons.
Aug. 17, 1882.—7⅛c.	8c.	9⅛c.	8¾c.	Jan. 1, 1882— 43,927 tons.
Aug. 18, 1881.—7 11-16c.	8½c.	9⅝c.	9¼c.	Jan. 1, 1881— 66,999 tons.

Stocks of Sugar in the Chief Markets of Europe on the 31st July, for Three Years, in thousands of tons, to the nearest thousand.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal *entrepôts.*	Total 1890.	Total 1889.	Total 1888.
113	87	125	89	19	20	453	330	534

Twelve Months' Consumption of Sugar in Europe for Three Years, ending 3slt July, in thousands of tons, to the nearest thousand.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal *entrepôts.*	Total 1890.	Total 1889.	Total 1888.
1327	463	508	286	50	373	3007	2790	2695

Estimated Crop of Beet Root Sugar on the Continent of Europe for the present Campaign, compared with the actual crop of the three previous Campaigns.

(From Licht's Monthly Circular.)

	1889-90.	1888-89.	1887-88.	1886-87.
	Tons.	Tons.	Tons.	Tons.
German Empire	1,260,000	990,604	959,166	1,012,968
France	800,000	466,767	392,824	485,739
Austria-Hungary	750,000	523,242	428,616	523,059
Russia	470,000	526,387	441,342	487,460
Belgium	210,000	145,804	140,742	135,755
Holland	60,000	46,040	39,280	36,098
Other Countries	80,000	87,000	79,980	69,127
Total	3,630,000	2,785,844	2,481,950	2,750,206

The estimate for Austria-Hungary seems to be turning out tolerably accurate. Mr. Licht thinks that, judging from accounts coming to hand, only a fairly good crop can be expected for the coming campaign, and that we may therefore suppose that the agricultural yield will probably not exceed that of the year now closing.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The cane sugar market during the past few weeks has been firm, with a decided tendency to advance, and prices may be reported as from 3d. to 9d. dearer all round. The advanced quotations have, however, checked business. There is a scarcity of most kinds for immediate delivery, which may increase before the new crop reaches us.

Beet sugar was as high as 14/3 in the middle of the month, but prices have receded, probably in consequence of the fine weather, and as refiners are operating with caution, this may continue for a short time. In face of the small quantity of cane expected to arrive, the quantity afloat being 25,000 tons less than at the same time last year, holders are not anxious to sell and seem to think they can do better by waiting. There is but little likelihood, however, of a permanent advance, and we shall almost certainly see lower prices for beet and consequently for cane sugars.

Refined sorts are again about 9d. dearer, with a steady market..

Stocks in Europe are some 123,000 tons higher than last year, though below the two previous years. The visible stocks and floating cargoes in Europe, North America, and Cuba, are roughly estimated at 90,000 tons more than about this time last year, and 125,000 tons less than in 1888.

The imports into the four principal British ports up to the middle of August are over 100,000 tons, and the deliveries over 50,000 tons behind those for the corresponding period of 1889.

Present quotations for the standard qualities, as under, are :—

Floating.			Last Month.
Porto Rico, fair to good Refining	13/– to 14/3	against	12/9 to 14/–.
Cuba Centrifugals, 97°/。 polarization	15/3	,,	14/6 to 14/9.
Cuba, fair to good Refining	13/3 to 13/9	,,	13/– to 13/6.
Java, No. 14 to 15 D.S...	15/6 to 15/9	,,	15/3 to 15/6.
British West India, fair brown	12/6	,,	12/3
Bahia, low to middling brown	11/– to 11/9	,,	10/3 to 11/–.
,, Nos. 8 to 9	12/6 to 13/–	,,	11/6 to 12/–.
Pernams, regular to superior Americanos.	11/6 to 13/6	,,	10/9 to 12/6.
Landed.			**Last Month.**
Madras Cane Jaggery..	10/3	against	10/–
Manila Cebu and Ilo Ilo	9/9 to 10/–	,,	9/9
Paris Loaves, f.o.b...	17/– to 17/3	against	16/3 to 16/6.
Russian Crystals, No. 3, c.i.f.	15/9 to 16/–		No business.
Titlers	18/9	,,	18/6
Tate's Cubes..	20/–	,,	19/6
Beetroot, German and Austrian, 88%, f.o.b.	13/6 to 13/–	,,	13/9 to 13/10½

THE SUGAR CANE.

No. 255. OCTOBER 1, 1890. Vol. XXII.

☞ The writers alone are responsible for their statements.

CHANGE OF ADDRESS.

All communications to be addressed to "The Editor of the Sugar Cane, Manchester."

For Table of Contents, see page i.

In our last issue we made a suggestion that cane-sugars should be made up in small packages properly labelled, as being of Demerara and other origin, so that the public would be able to get real colonial cane sugar, and not beet sugar got up to resemble the genuine article. We are informed that the old-established house of James Philip and Co., 4, Fenchurch Buildings, London, are supplying pure cane sugar put up in bags of 14lbs. and upwards, marked and guaranteed as such, the place of origin, whether Demerara, Trinidad, or Barbados, being distinctly stated. It is satisfactory to learn that a house of such undoubted respectability and long experience, which is in a position to offer a sufficient guarantee of genuineness, has adopted this method, and it is much to be desired that the public may avail themselves freely of this means of getting the real article, which to a true connoisseur in sugar, so much surpasses the beet-root imitation, that nothing but ignorance and heedlessness, or a very short-sighted parsimony, can have led to the substitution of the latter much inferior article for the good old, really sweet, raw cane sugars of our juvenile days. Some of us who are on the wrong side of fifty may have been fancying we had lost our taste, but a trial of the genuine article will very probably prove this to be a delusion, caused by the very poor stuff which housewives have had foisted on them as Demerara crystals, &c. We question whether the peculiar smell, so characteristic at one time of all raw beet sugar, is even now perfectly eliminated from these pseudo-Demerara, Trinidad, and other sugars.

According to a Barbados paper between 70,000 and 80,000 hhds. of sugar and about 50,000 puncheons of molasses have been exported of this crop up to now, against less than 60,000 hhds. and some 42,000 puncheons last year at the same time, and there is still a good quantity left for shipment.

According to an official announcement His Excellency the Governor of British Guiana, acting under the provisions of Ordinance No. 11 of 1882, has been pleased to appoint J. B. Harrison, Esq., Government Analytical Chemist, to be Government Analyst for the purposes of the said Ordinance.

We hear from Jamaica that some apprehensions are being felt as to the possible non-success of the forthcoming International Exhibition which the Governor has so indefatigably been engaged in promoting. The reasons seem to be of a purely financial nature, and it is much to be hoped that these lugubrious anticipations may not be verified. An announcement in the English papers that Mr. S. Lee Bapty, the energetic and successful general manager of the Manchester and Edinburgh Exhibitions, has accepted a similar appointment in connection with that of Jamaica, warrants us in anticipating that the opening months of the coming year will witness as thoroughly satisfactory Exhibition there as those with which Mr. Lee Bapty has been so prominently connected in this country.

The following report on the Cuban Sugar Crop is from the *Havana Weekly Reporter*:—According to a statement just published by Messrs. C. L. Deetjeen & Co., of Matanzas, the crop just over in Cuba amounts to 675,233 tons, which total shows an increase of 102,930 tons, equivalent to 24%, on that of last year.

This increase is due chiefly to Cienfuegos, Caibarien and St. Jago de Cuba, inasmuch as the returns show a decrease of about 17% at Sagua, and the production in the other sugar districts of the Island was the same, more or less, as that of last year.

A large part of the Sagua crop, 46,923 bags of sugars, were shipped this year to Spain, chiefly to Barcelona, a fact that proves that planters have considerably improved their manufacturing process, it being well known that only sugar of superior classes is exported to Spain.

On the 27th ult., the members of the Scottish Sugar Refiners' Association met at the Tontine Hotel, Greenock, and presented Mr. Thomas Neill with a magnificent writing-table, on his retirement from the Honorary Secretaryship of the Association, "as a mark of their high appreciation of his valuable services, and of the efforts he made for the removal of State bounties on sugar, during the long period (15 years) he acted as honorary secretary."

The readers of this journal do not need to be reminded of the indefatigible zeal displayed by Mr. Neill in the endeavour to bring about the abolition of the obnoxious bounties.

Sir J. Pope Hennessey is responsible for the statement that Mauritius is the most flourishing sugar-producing colony of the British Empire. The relative greater prosperity of the sugar trade of Mauritius compared with that of the West Indian islands is said to be partly owing to the Mauritius planters having the command of the Indian and Australian markets, which are too remote from the West Indies for competition for the planters there. The greater facility for obtaining coolie labour from India is also probably an advantage. The most important economic difference between Mauritius and the West Indies, however, is the fact that nearly all the owners and managers of the sugar estates are natives of the island in the former case, absenteeism being much more characterstic of the West Indies. The great fall in the price of sugar in recent years has been met by the Mauritius planter to some extent, by means of *prudent reduction of expenses and the adoption of improved processes so as to increase the yield of sugar from the cane.*

Since the report of Sir J. Pope Hennessy was made, the sudden appreciation in the value of silver has materially changed the situation in Mauritius, and the planters and merchants are actively engaged in considering the difficulties caused by this and by the competition of German sugars in the Indian market.

In calling attention to the articles on the Growth of Sugar Cane in India, to be found on page 513 we would remark that on the 3rd July the Austrian Lloyd steamer "Poseidon" left Trieste with 2,999 packages of sugar for Calcutta. This is "carrying coals to Newcastle" with a vengeance, and our Indian sugar refiners and producers should really look to it that they are not out-generalled in their own country.

We regret that we have not space this month for the official statistics of the last campaigns in France and Germany, but must content ourselves with the following figures:—

FRANCE.

Campaign.	Factories at work.	Production (in Refined). Tons.	Percentage of yield.
1881–82	486	335,575	6·10
1882–83	496	362,737	5·03
1883–84	483	406,007	5·55
1884–85	449	272,962	5·99
1885–86	413	265,084	7·83
1886–87	391	484,043	8·86
1887–88	375	347,785	9·62
1888–89	380	414,869	9·83
1889–90	373	700,409	10·50

The enormous increase of the 1889–90 campaign is to be attributed mainly to the progress made in the cultivation of rich beets, assisted by specially favourable atmospheric conditions, as the area under cultivation was only about 10% above that of the preceding year.

GERMANY.

The same favourable atmospheric conditions have had a similar effect in Germany, where the area under cultivation was about the same as last year, whilst the production, as will be seen from the figures was more than 26% greater than in the preceding campaign. The total production of the campaign just closed (August 31st) was 1,265,000 tons against 990,604 tons in 1888–89, the yield being about 12½ per cent. in the former case. These figures are Mr. Licht's, and they differ somewhat from those of the *Deutsche Zuckerindustrie*, the mode of computation employed being somewhat different.

With regard to the progress of the French production, the latter journal remarks:—

"The fact cannot be concealed that the progress achieved by the French beet sugar industry as compared with the German is being made at a much quicker rate than our own, although they have not reached either our quantity, or the yield obtained. As regards the campaigns of 1888–89 and 1889–90, the German production was 26·19 per cent. greater, while that of France was actually 68·78 per cent."

On page 546 of the present issue will be found a letter from Mr. Nevile Lubbock, in which he takes exception to the statement, which we lately hazarded, to the effect that the Beet Sugar Manufacturers would still have been able to maintain their present position even if the bounties had been abolished.

Mr. Lubbock, whose experience as a practical sugar manufacturer and great knowledge of sugar matters in general lend a weight to his utterances, greater than would attach to those of any other man in England, speaks with some diffidence on the subject before us, as well knowing what he rightly terms "the great complexity of the problem." We may as well state at the outset that we not only have not the least desire to establish the opinion we have expressed, but should be exceedingly glad if the fact could be proved otherwise. And it is probable that even if we were to succeed in placing before those interested a fair statement with full details of the cost of manufacture, &c., of raw cane and beet sugar respectively, the difficulty of (as it were) stating the equation, of establishing an accurate basis of comparison, would still lead different readers to exactly opposite conclusions.

We are in presence of one fact which is indisputable, that beet sugar has replaced cane sugar to an extraordinary extent, and the mere fact that it is continuing to hold its own, and that German beet sugar manufacturers, in spite of the reduction of the bounty to a comparatively insignificant figure, are still making large profits, is one of very considerable weight. However, as far as the view which we expressed last month is concerned, we freely confess that it is an opinion which has steadily grown upon us in dealing for several years with the figures met with in German, French, and other Continental sugar journals, and in official statistics, in conjunction with the conviction of more than one fairly competent individual with whom we have come in contact, rather than as the result of such calculations and comparisons as are required to supply absolute proof.

For, in fact, the individual who can thus thoroughly deal with such a problem needs an experience rarely possessed by any one man; he should not only be a practical colonial sugar manufacturer, but also a practical beet sugar manufacturer. However, the duty is undoubtedly imposed upon us of contributing as much as possible to the settlement of the question, though, from the difficulty attending the obtaining of statistical information as to the cost of cane sugar production, the task is exceedingly arduous. Fortunately, the Report of the

Colonial Company, Limited, supplies us with at least one clear statement which can be used with confidence. And we hope to be able, in the November issue of this journal, to supply figures with regard to one (if not more) fairly representative beet sugar factory as will justify the remarks which we are about to make. If the result of any efforts to discharge this duty should, after all, be to show that we have been mistaken, no one will be more satisfied with such result than those connected with this journal, which has now for twenty-one years (completed last month) steadily endeavoured to promote the interests of those engaged in the production and manufacture of cane sugar.

And firstly, as regards beet sugar, where we shall confine ourselves mainly to German factories. It is well known that in Germany all "Actiengesellschaften" have to publish in the Official Gazette a certified detailed account of their transactions. The questions to be taken into consideration are—

1. What is the cost of production of the beet?
2. What is the cost of production of the sugar, bounty and duty free.

The first question is answered by comparing the various figures given in the official records. Working on these and assisted by reliable information, we arrive at an average figure of 16s. per ton. Undoubtedly many factories have to pay more for their beets, but we must take into consideration the fact that the German farmer is in the majority of the 400 German beet sugar factories himself the proprietor, and hence we can only take the cost of production as the basis of calculation for our purpose. In France the sugar manufacturer has to buy his beets from the farmer, but as they both stand or fall together the calculation will not be much affected.

To answer the second question, we again fall back on the official reports. Calculation has been made in Germany of the working expenses, leaving out or making allowance for bounties and duties, and also for the deductions made for the exhausted beet slices (supplied as fodder), filter press and other scums, and molasses, taking account also of all sums required by the law to be applied to amortisation, the average figure arrived at being a cost of £9 per ton of ordinary 88° beet sugar delivered at the German Railway Station, bounty and duty both being left out of the account. This equals 9s. per English cwt.

As regards cane sugar, the valuable report of the Colonial Company,

Limited, states through Mr. R. Gillespie that the Company produced, in 1889, 22,730 tons of cane sugar at the following prices:—

Vacuum pan sugar, £13 13s 0d. per ton=13s. 6½d. per cwt. loco. London.
Muscovado sugar, £11 10s 0d. ,, =11s. 5d. ,, ,, ,, ,,

The report adds that there are no estates in the West Indies in finer order than those of the Company, and none better managed. That being the case, we are bound to believe that many if not most less well managed estates are working at a higher cost, and that we cannot take the above figures as representing anything like an average.

But there can be no doubt of the fact that the English and other Colonies are doing a good deal to reduce the cost of production and get more sugar from the cane. Yet it must not be supposed that the European beet sugar producers have either got to the utmost possible pitch of improvement, or are relaxing their efforts. The careful selection of seed, though a slow process, as it requires three or four years to get a sufficient supply of seed from the selected improved plants, will, it is confidently expected, shortly result in the regular growth of beets of 18% saccharine content. Last crop, we are informed, the saccharine content averaged 14% nearly all round, while ten years ago only 11% was considered a good figure. In France, ten years ago, 7% was more than an average, they are now growing beets of 12 and 13% saccharine content. The adoption of improved mechanical appliances, such, for instance, as the use of the multiple effet, which requires about 12 cwt. of coal per ton of sugar, instead of nearly double as in former years, is certain to continue, and along with it the constant invention of further mechanical means of cheapening production. And as regards the intelligent direction of the factories, there are more than 1000 thoroughly educated technical chemists at work in Germany during the campaign. The want of such intelligent direction and control is certainly one cause of the poor success of improved machinery and processes where they have been introduced in some cane sugar producing countries.

As regards the question of wages, mentioned in Mr. Lubbock's letter, it does not seem likely in our opinion (*quantum valeat*), that this will prove an important factor. A large portion of the work in agriculture is done by children, and implements are in universal use. Neither the agricultural labourer nor the workmen employed in the factories are as intelligent or in any way so capable of organisation as the English, nor are they powerful enough to raise wages sufficiently to endanger the exporting capacity of the country.

The average pay of the labourers in France in 1881-82 and 1888-89 was as follows:—

	1881-2.		1888-89.	
Men....	2fcs. 97cmes.	..	2fcs. 69cmes.,	a diminution of 27 centimes per day.
Women.	2fcs. 00cmes.	..	1fcs. 92cmes.,	,, ,, 8 ,, ,, ,,
Children	1fcs. 76cmes.	..	1fcs. 71cmes.,	,, ,, 5 ,, ,, ,,

And we are inclined to believe the state of things in most European beet growing countries is much the same.

Prices of coal are undoubtedly higher than formerly, but it is an open question whether the economy effected by improved machinery and apparatus does not balance this.

There is one statement in Mr. Lubbock's letter which we should gladly accept as accurate, but which we fear requires qualification. He says "modern machinery has almost entirely supplanted the old process." We do not deny that great progress has been made during the last ten years, and that many estates are reducing their cost of production, but the words "almost entirely" are surely too strong. British Guiana is with some right looked on as the model quarter, in the West Indies, for sugar manufacturing, but we think the figures for other parts of the West Indies would show a rather worse state of things than that indicated by the Report of the Colonial Company,

We fear that at the slow rate at which improvements are adopted, in comparison with the constant rapid progress achieved in the beet sugar manufacture, our opinions as to the evil case of the cane sugar industry may prove too well founded, and we feel constrained to repeat our warning as to the danger of delay or half measures. England has suffered in her national (whether home or colonial) prosperity from the indifference and false security begotten of success, and the descendants of those who made her colossal wealth in the past are but half awake to the dangers which threaten them from those whose present position is an outcome of their alertness, keenness, and intelligence, and whose existence depends entirely on the maintenance of these qualities.

We are speaking of things as they are, but not as they might be, for whilst nearly all the available sugar is got from the beet, this has never yet, we believe, even with diffusion, been effected in the case of cane. Again the beetroot production has been assisted by careful rotation of crops, and thorough utilisation of by-products, neither of which is true of the cane, except perhaps in Java, as regards rotation of crops.

ON GROWTH OF SUGAR CANE IN INDIA.

At a meeting of the Agri-Horticultural Society of India, held at Calcutta, on the 30th July, Mr. Criper presented the following suggestive note on the growth of sugar cane:—

I am enabled, by the kind permission of Mr. Macalister, of the Rosa Sugar Works, to place some analyses made by me at that place, before the Society, illustrating the gradual formation of sugar in the sugar cane, at different periods of its growth.

The cane was analysed in July, September, and November. The three joints at the bottom of the cane, and the three at the top, just below the commencement of the leaf, were taken for analysis, the middle joints being left.

Analyses of Canes at Different Periods of their Growth, showing the Progress of Ripening.

1st Analysis.—July 31st.

Height to end of leaves	8ft.
,, beginning of leaves	3ft.
Weight of cane, whole	11 chittacks.
,, cane only	7 ,,

	Top 3 Joints.		Bottom 3 Joints.
Cane sugar	nil	....	2·00
Glucose	1·28	....	1·60
Ash	·96	....	·73
Cellulose	6·00	....	13·95
Organic matter soluble	1·68	....	·69
Acid (acetic)	·22	....	·06
Water	89·86	....	80·97
	100		100
Total juice	94%	....	86%.

Analysis of Canes.

2nd Analysis.—September 12th.

Height of cane to end of leaves	9ft. 6in.
,, ,, beginning of leaves ..	5ft. 4in.
Weight of cane only	10 chittacks.
,, whole	14 ,,

	Top 3 Joints.		Bottom 3 Joints.
Cane sugar	nil	....	8·00
Glucose	2·69	....	1·03
Ash	·88	....	·69
Cellulose and Albuminous matter ..	10·82	....	15·09
Acid	·09	....	·06
Water	85·52	....	75·13
	100		100

3rd Analysis.—November 7th.

Length of cane to end of leaves .. .. .. 12ft.
,, ,, beginning of leaves .... 8ft.
Weight of cane, whole .. .. 1 seer 7 chittacks.
,, cane only .. .. 1 seer.

	Top 3 Joints.		Bottom 3 Joints.	
Cane sugar	nil	..	8·00	
Glucose	2·12	..	·16	
Ash..	1·12	..	·83	
Cellulose Albuminous matter.. ..	15·54	..	21·19	Cellulose.. .. .. 17·92 Sol. organic matter. 3·27
Acid	·06	..	·07	
Water	81·16	..	69·75	
	100		100	

Total juice .. .. .. 82%.

From the above analysis it will be noticed—

1st.—That the top joints contain no cane-sugar in November when nearly ripe.

2nd.—That glucose is invariably present, being highest in September in the top joints, and lowest in November in the bottom joints, *i.e.*, when the cane is about ripe.

3rd.—The top joints contain about 10% more water than the bottom ones, and this ratio does not appear to alter during ripening.

4th.—The amount of water present is from 8 to 11% more in July than in November.

Analysis of Cane Juice at Different Periods gave the following Results:—

	1st Analysis, Aug. 31st.	2nd Analysis, Sept. 29th.	3rd Analysis, Dec. 10th.
Height of canes to commencement of leaves	4½ft.	5½ft.	5½ft.
To end of do.	9ft.	10½ft.	10½ft.
Specific gravity of juice	1·037	1·04	1·071
Cane sugar	4·25	8·00	16·00
Glucose	1·27	2·00	·31
Ash	·73	·78	·73
Albuminous matter	1·51	·89	3·25
Acidity	·16	..	..
Water	92·08	88·33	79·71
	100	100	100

The rise in the amount of albuminous matter, and decrease in the glucose, between September and December is particularly noticed.

It appears probable that the plant organism effects the conversion of the glucose into cane sugar by combination with the elements of water.

The foregoing shows how wasteful is the practice common in some parts of India, of reserving whole canes for seed purposes instead of utilizing only the upper portions of the plants, the West Indian method, as pointed out by Mr. Goodridge (see the Society Proceedings, September, 1885),—"The West Indian planter would consider it pure "waste to use his mature cane for seed. . . . . The tops are carefully "cut off, the stems and blades are used as fodder, and the cane tops, "about a foot long, are carefully preserved in trash, till the time for "sowing arrives." Mr. Goodridge remarked that besides saving the mature cane for the mill the use of tops for planting had other considerable advantages which he pointed out.

Manuring.

In connection with the subject the following extract from a note by Mr. J. J. Willis in the *Gardeners' Chronicle* for the 12th July is of interest:—"In experiments at Rothamsted with the sugar yielding "root crops, it was found that there was more sugar produced the "larger the amount of nitrogen applied as a manure, although not in "proportion to the amount supplied. Also that the efficiency of a "given supply of nitrogen is greatly dependent on the available "minerals of the soil. Taking the mean of many investigations in "which potash formed an ingredient in the manural supply, it was "found that 1lb. of nitrogen in manure yielded 20lbs. of sugar."

INDIA.

Sugar Cultivation.

In our June number will be found an article under the title "Sugar Production in India" containing extracts from a letter addressed by Messrs. Travers and Sons, Limited, in which they suggested to the Secretary of State for India the establishment of model factories for the production of sugar with a view to the improvement of the manufacture in that country. The reply of the Indian Government to the suggestions then made was also given by us at length, and also a letter from Mr. Kollman, the manager of the Aska Works (Madras), advocating the establishment of central factories.

We now learn that Mr. Francis Gill, manager of Messrs. Perry and Co's factory at Nellikappam (Madras) has written to the Madras Government on the subject of the very inferior kind of canes generally grown for the production of the poor kind of jaggery which is the staple sugar article of the country, and advocates the use of the Coimbatore cane, which he considers to be the "green Salangore" though the Madras Board of Revenue classes with the "Bourbon" cane. His idea, as a practical analytical chemist is that depôts should be established furnished with the necessary appliances for making accurate analyses of the various sorts. The response to his suggestions does not seem to be more encouraging than that which the proposals of Messrs. Travers and Sons met with.

After giving some figures showing proportionate differences of value, Mr. Gill makes suggestions as follows:—

"It would be interesting to estimate the value to India of the cultivation of a good sugar cane as against the present cultivation in most part of the jaggery or treacle cane. The figures supplied give a rough approximation of the difference of value proportionate to units of available sugar in the canes. Such valuation, however, takes no account of increased value on a sliding scale with rise of yield of sugar owing to the less cost of turning this out, and consequently the comparative valuation of the better cane is considerably under the mark. The Bellary jaggery with its available sugar of 47·47 per cent. is a fair representative of Indian concrete jaggeries as a whole, and therefore the value of Rs. 193 per acre may be considered for present purposes what average value of cane cultivation is for jaggery exported or used locally for making white sugars, and Rs. 317 value

of cane cultivation as it might be for such jaggery-difference of Rs. 124 per acre. The acting Director of Lands Records and Agriculture, Bombay, in his letter No. 1715, on the 24th August, 1889 to his Government, reproduced in the Government of India Circular under notice, puts down 167,400 acres as the total cane cultivation of British India. If we take 60,000 acres as the area under cane for making jaggery for export and for conversion into refined sugar, we have a value of Rs. 7,440,000 lost on present cultivation. From what has gone before, I think it will be agreed that establishment of model factories for teaching the people how to make sugar or more valuable jaggery from their cane is superfluous, and that what is required, primarily at least, is a knowledge as to what cane is the best sugar cane under the conditions of soil and climate of the locality concerned. This established, I believe the ryot may be left to cultivate the cane after his own methods, with the indication to him in the case of a variety of cane new to him, of the seasons for planting and cutting, in the certainty that he will do the best thing for the cane possible to his means. With the advent of good jaggery, an enormous demand for it, and the erection of large works for converting it into white table sugars may be relied upon to come about spontaneously and without Government assistance. The knowledge as to what is the best cane, I think can in this country, only be searched for by Government, and the best way of doing it within a reasonable time would be to maintain depôts of observation throughout the country in cane-growing districts, with complete apparatus for sugar—and may be soil analysis, and in competent charge to make all analyses required for demonstrating the nature of the cane of the neighbourhood, and to forward them for tabulation and comparison to a central office. The number of years that would be required to collect the fullest information on the subject would depend upon the number of depôts established, and the area of country they could be made to command. A depôt might certainly command a two days' journey, and probably might command three without prejudice to the truth of the analysis of the cane concerned in such a journey. What study has done for beet sugar may be told in a few words. In 1860, total production was 329,000 tons from a yield of about 5 per cent., and in 1889 it was 2,764,457 tons from a yield of 12·39 per cent. of raw sugar (13·77 per cent. in previous year). Taking the ideal Green Salangore, with its juice containing originally 19 per cent. dissolved solids, we should obtain 13 per cent. jaggery from it with

an extraction of 63 per cent. juice in the mill, or 16·6 per cent. jaggery with 80 per cent. extraction by diffusion, and this jaggery would give 86·4 per cent. sugar = 11·23 per cent., and 14·34 per cent. refined sugar by the respective processes on the cane, and beet is said to already give 11·12 per cent. It has been said in the past that cane sugar would always be able to hold its own against beet sugar, since the cane was so much richer in sugar than the beet. The dictum was mainly based on a misapprehension as to what is sugar, and for the rest, improvement in beet roots grown has more than made up the leeway, and it remains to be seen what the limits of production of beet sugar will prove to be, and what factor in the determination of these limits cane sugar will prove to be. Cane concrete jaggery for direct consumption in India at least will always be able to take care of itself, but the existence of cane table sugars and all that is involved commercially in their manufacture and carriage is in imminent jeopardy, and can only be maintained by an improvement in the sugar cane itself."

It is to be hoped that these repeated representations may ultimately lead the Indian Government to take a more direct, active, and practical interest in the important question of the improvement of the very backward cultivation and production of Indian sugar.

FRANCE.

Sugar Legislation.

The following is a translation of the text of the new French Law of the 5th August, 1890. [See *Sugar Cane* for November, 1889, pp. 581 to 589, for the text of previous enactments.]

The Senate and the Chamber of Deputies have adopted—

The President of the Republic promulgates the law, the tenor of which follows :—

Article 1.—Commencing with the campaign of 1890-1891, home or colonial sugars representing, in virtue of the laws of 29th July, 1884, 13th July, 1886, and 4th July, 1887, excédents of yield or allowance for loss in manufacture shall be subjected to a special duty of 30 francs per 100 kilos. of refined sugar.

These sugars shall be admitted into bond under suspension of the payment of the duties to which they are liable.

Excédents ascertained in establishments which are under inspection and derived from beets put in work during the campaign of 1889-1890

shall remain subject, up to the 31st December, 1890, to the tariff at present in force.

Article 2.—Sugars from every source which are used in sweetening wines, ciders, and perrys, shall be subject to a duty of 24 francs per 100 kilos. of refined sugar.

Article 3.—The duties upon raw, refined, or candied sugars, from every source, other than those which form the subject of the two preceding articles, as also on sugar derivatives, shall continue to be levied in conformity with the tariff established by the laws of the 27th May and 24th July, 1888.

Article 4.—The duty on home-manufactured glucose is raised to 13 francs per 100 kilos., décimes and half décimes included.

Article 5.—The provisions of the third paragraph of Article 18 of the law of 19th July, 1880, by virtue of which sugars cannot be subjected to duties or temporarily admitted into bond at a rate of yield higher than 98 per cent., whatever their supposed yield in refining, are abolished.

Article 6.—The allowance for loss in manufacture granted by Article 2 of the law of July, 1887, to sugar distillers, is raised to 20 per cent., commencing with the campaign of 1890-1891, for those distilleries which were in existence at the time of the promulgation of the said law.

Article 7.—The surtax of 7 francs on raw sugars not classed with refined sugars imported from European countries or entrepôts, which expired on the 31st August, 1890, is extended until the 22nd February, 1892.

Article 8.—Sugar refineries are subjected to the permanent surveillance of the officers of the indirect taxes.

This surveillance is to be exercised exclusively on the entry or exit of products received or sent out by the refiners, except at the time of stock-taking, as dealt with in Article 10, when it extends to all the products on hand in the works.

Article 9.—No other sugars shall be allowed to enter the refineries than those previously subjected to duty or declared in temporary admission on the conditions fixed by the laws and regulations in force, and by Article 5 as stated above.

The duties levied accrue definitively to the State, whatever may be the final result of the refining.

Article 10.—The Excise Officers shall keep an account of the entries and deliveries of sugar received and sent out by the refiners.

An annual stock-taking shall be made by the said agents. If as

the result of this stock-taking the balance of account shall show an excess, this excess shall be added to the charges, and the full duty, according to the present tariff, viz. :—60 francs per 100 kilos., shall at once be levied on it.

In conformity with the last paragraph of the preceding article, deficits will not entitle to any restitution of duty, but will simply be entered in the account under the head of deliveries.

On the day on which the present law comes into force, stock shall be taken in the existing refineries. The quantities of sugar scheduled shall be entered in the account of the refiner as products exempt from taxation.

Article 11.—The dispositions of Article 4 of the law of 31st May, 1846, with the modifications made in them by the laws of 1st September, 1871 (Article 6), and of 30th December, 1873 (Article 2), shall be applicable to refineries.

Article 12.—A decree shall determine the conditions of the surveillance to be exercised in the refineries, and the obligations to be fulfilled by the refiners.

In the case of sugars destined for home consumption, this duty is payable on the entry of the sugar into the works. As regards those entering under the regulations for temporary admission with a view of being exported after refining, the duty is guaranteed by the declared statement.

Exemption from this tax is granted when the declarations are discharged by export certificates, which are granted exclusively for refined sugars.

Article 14.—Contraventions of the provisions of the present law, and of the provisions of the decree to be issued in execution of Article 12 above stated, shall be punishable by the penalties attaching to Article 3 of the law of 30th December, 1872.

Article 15.—The provisions of Articles 2, 3, 4, 5, and 7 to 14 of the present law, shall be applicable from the time of the promulgation of the present law.

The present law, deliberated on and adopted by the Senate and the Chamber of Deputies, shall be executed as law of the State.

Done at Paris, August 5th, 1890,

By the President of the Republic,

Carnot.

The Minister of Finance,

Rouvier.

THOUGHTS ON DIFFUSION.

(Letter to the *Planters' Monthly*).

The experiments now being made in the Hawaiian Islands with diffusion speak well for the enterprise of the planters, and show plainly that they do not intend to be left behind in the march of progress. These experiments cannot fail to be instructive and useful to every one interested in the manufacture of sugar, and this is a still more pleasant thought when we remember that from these almost unknown islands, some of the most useful machines have been invented and now are universally used. Our planters have always been quick to adopt the most useful inventions of other sugar producing countries, and most of the mills are filled with powerful and costly machinery, and possess all the mechanical outfits necessary for first-class work.

The outcome of all these combined improvements has been beneficial in the highest degree, and has resulted in a gain in many instances of a hundred per cent. over the old methods. After arriving at so high a degree of efficiency and getting everything possible for good grinding, many of the planters are branching out in a new direction to see what further gain can be derived by the process of diffusion.

Whether this will result profitably remains to be proved, but however this may be, we cannot help admiring the pluck, energy, and enterprise of the men who have undertaken at their own expense to solve this important problem, whatever the cost or difficulties may be. The experiment is a more expensive matter than may generally be supposed, that is for the pioneers of these islands, who engage in it. This is to be expected in any new departure or entirely new process.

Diffusion is considered, by many and particularly by those persons that have most to do with it, as beyond the experimental stage. It is a success in Louisiana, but this fact does not insure a like success here, for the conditions are essentially different. The fuel question which is supposed here to be the greatest drawback is found at their very doors, and can be got very cheaply, while here the reverse is the case; but we have some advantages over them in this particular item of fuel, for while they in most instances derive very little benefit from and make no use of the exhausted chips, we readily burn them,

and find that they have considerable value, constituting three-quarters and never less than two-thirds of all the fuel needed. The greater amount of fuel needed by diffusion is evidently due to the inferior quality of the chips, but it is also apparent that a greater amount of heat is needed by diffusion, that notwithstanding neither clarifiers nor cleaners are used. This is mainly due to the dilution of the juice, which amounts from 20 to 30 per cent. The fuel question is certainly a drawback to diffusion, but it is not so serious a matter as was anticipated, for the extra fuel needed does not appear to exceed 700lbs. of coal to the ton of sugar, and may eventually be reduced considerably below this figure.

The best thing in diffusion is the extraction. This evidently cannot be surpassed by any other known process. It is undoubtedly the best means of extracting the juice from the cane. It is done with ease, dispatch and thoroughness, and with comparative safety, although to press the chips to a sufficient dryness the mills must still be set to exert their greatest strength. With diffusion, all of the saccharine matter could be extracted, were it advisable to do so, and herein is found its greatest advantage. But such thoroughness is not arrived at, not being considered profitable.

There seems to be a disposition to take a different basis of comparison between diffusion and grinding. With grinding we usually take the cane as a basis, but with diffusion it is usually the available sugar; and so if half of one per cent. be lost, it means rather more than the same quantity of juice as expressed with grinding. There is a possibility of waste by diffusion, if care be not exercised in every department. If slicers are used, the extraction is found to vary according to the thickness of the chips, being less as they increase in thickness, and *vice versa*. It also depends to some extent upon the heat of the battery being maintained at the proper temperature, as well as the circulation, pressure and size of the cells.

The purity of the juice is said to be in favour of diffusion. This may be true under some circumstances—and the best conditions; but the novice in diffusion will probably find the reverse to be the case. He will probably find that the first sugar does not work, boil, or grain up as well as it might be expected to do, while the second sugar may be worse, and the third still worse. Now this may not be the fault of diffusion so much as some defect in the management of the battery or the manipulation of the juice. The usual practice here is

to do the clarifying, cleaning, &c., in the cells of the battery, but whether this is the proper thing to do under all circumstances is a question. The fact that this method works well in one district does not prove it will in all. It is well known that the sugar cane varies greatly in different soils and climates, and it may to such an extent as to require a totally different treatment. This, however, is a matter which each individual will have to decide for himself.

In Louisiana, where presumably this subject is better understood, the clarifiers are still used, as it is considered impossible to perfectly clarify the juice in the cells. This may be caused possibly by the different methods of preparing the cane for diffusion, and again it may be caused possibly by the cane. Be this as it may, they consider they get better results by using clarifiers. The primary object there, seems to be, not only to get high extraction, but at the same time to get the juice at the greatest purity. There can be no question as to the advantage of this, particularly to those persons who have witnessed the loss of time, of sugar, and not to mention the trouble attending imperfectly defecated juice.

Governor Warmoth, of Louisiana, writing on this subject, mentions having noticed that diffusion juice and syrup ferments more quickly than mill juice, and admits of losing 100,000lbs. of sugar before they learned to prevent; but, unfortunately does not say what means he took to do so. This gentleman is one of the foremost and progressive planters in America, and if he admits of losing so much, possibly others are losing something too.

It is to be hoped that every difficulty will eventually be overcome, and if it is proved that the clarifying can be perfectly accomplished in the battery, one of the chief ends will be achieved. There can be no doubt that the proper working of the battery has much to do with the clarification of the juice, for if it work too slowly, the more impurities are dissolved. It also appears important to keep the battery at the proper temperature, and to work everything with regularity and great carefulness.

The changes necessary, when changing from grinding (above what is needed for diffusion) are not great, when it is known to a certainty just what is needed. The greatest changes are made in the furnaces, and it is also evident that if the battery is to work up anywhere near the same quantity of cane, a larger triple effect is required. The triple effect should be capable of doing the work with ease, and to

concentrate the juice to any required density in order to prevent loss of time and waste of fuel.

The extra amount of labour required in diffusion appears to be its greatest disadvantage, as it is in continuous operation two sets of men are needed, while it seems to be impossible to get twice as much sugar as was made by grinding.

But the relative gain by this method I will leave to others to work out.

I remain, yours truly,

INVESTIGATOR.

BRITISH COLUMBIA.

THE SUGAR REFINERY AT VANCOUVER.

(From the Vancouver *Daily Telegram.*)

One by one manufactories and wholesale houses are taking their places among us, without attracting any great attention, but the establishment in our midst of a sugar refinery is a matter of more than ordinary importance, and deserves more than usual attention. Its importance to the place is by no means measured by the number of men it employs or the amount of money it will disburse at this point, but rather by the impetus it will give, and the manifest advantage it will be to the wholesale trade to this city. No other industry would be so potential in making Vancouver a great commercial centre as this. For the mainland trade it will give our wholesale dealers a tremendous advantage over Victoria merchants, who would have to pay double freight, wharfage and drayage between here and there. If the country merchant can buy his sugar cheaper here, we can sell him all his groceries and provisions, and while buying those here he will not go elsewhere for such other goods as he may need, and which we are able to supply. It is needless to say that when such an advantage exists there will be no lack of jobbing houses.

Having thus glanced at some of the immediate results likely to follow the establishment of this manufactory in Vancouver, let us look at the works themselves. Taking the street cars we are soon at the Powell end and within a few rods of the site, which is located just east of the kiln works, embracing a space fronting the railroad track, on the north side, of 150 feet by a depth of 300 feet, and having

a wharf extending from this into the Inlet 250 feet, of a uniform width of 100 feet. This front is separated from the railway track by a high and substantial picket fence, except at the south-west corner, where stands a small, neat vestuble office, through which one must pass to the works, unless the double gate, a little to the east, which forms a part of the fence, happens to be open. From this gate there is a planked roadway across the track to Powell Street. On the west side, and about 30 feet north of the aforementioned office, is the main office building. It is frame, of neat cottage design, 40 feet by 40 feet, containing seven well-lighted and commodious rooms. About 20 feet north of this, and also along the west side of the grounds, stands a substantial building, one storey in height, 48 feet by 50 feet. This is the machine and blacksmith shop, divided into two rooms, the front, and much the largest one, being the machine shop. This building is made substantially fireproof, and is supplied with the latest and most improved machinery, and it is designed here to repair and make such parts as may be necessary, and do all the blacksmithing work. A strip commencing at the east end, and extending along the front 100 feet, will be used for a warehouse and shipping platform. This will be 45 feet wide and a spur or switch from the main railroad track will extend along the south edge. Next north of the warehouse there will be a driveway 30 feet wide. Over this driveway the roof from the warehouse will be extended, which will be covered with corrugated iron. Directly west of the warehouse is to be erected a cooper shop. Immediately north of the driveway, being 75 feet from the front line of the grounds, and leaving sufficient space on both the east and west ends, we come to the sugar refinery building itself, which is 107 by 98, and will be six floors in height. The walls are now up beyond the first storey, and as many workmen are being employed as can be used to advantage. The outside walls are from 26 to 28 inches in thickness, built of solid brick, the outside brick used being the white Winnipeg, which give the building a very fine appearance. The building is separated into four parts, denominated the boiler house, the melting house, the black house, and the refinery. These are separated from each other by fire-brick walls 28 inches thick, and rising to the roof, which will be of iron. The building will therefore be substantially fire-proof, and the inside of either of the "houses" of which it is composed might burn out without endangering the others. The black house is eventually to be carried up eight storeys,

and is lined throughout with iron and brick. In this is located the revivifying kilns and filters. The melting house is where the raw sugars are received and melted and defecated, and where the primary filtration takes place. In the refinery, the liquor is pumped from the filters in the black house to the top floor of the refinery, where crystalization takes place, and then passes down to the centrifugal machines, when the syrup is removed, and thence to the different departments of the refinery, when it is converted into the different grades of refined sugar, viz.: granulated, cube, powdered, and all grades of yellow. The building is being most substantially erected, and with sufficient strength to enable the walls to be carried still higher. The columns which support the kilns in the top of the building have iron base blocks six feet square, and these are placed upon stone and cement foundations, seven feet deep. In the boiler-room will for the present be placed three boilers of 100-horse power each, and space has been provided for five additional boilers whenever needed. The machinery is all from the east, and of the latest, best, and most improved pattern. On the wharf will be the raw sugar warehouse. The present arrangements are for a capacity of 200 barrels daily, but when the black house is extended to eight storeys, and the additional boilers added, the capacity will be fully 500 barrels per day. The roof of the main building will be on in September, and some time in November the work will be completed and running.

Already arrangements have been made for the necessary supply of raw sugar, and the first consignment will be here within the next two months. The raw sugar will be brought from Manilla, Java, and Cuba.

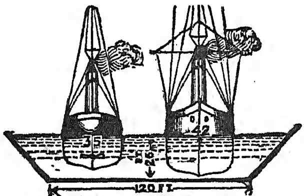
The works are being erected, and the business conducted under the superintendence of Mr. T. Rogers, managing director. Mr. Rogers is understood to be connected with one of the leading refineries in New York, and has a thorough knowledge of the business, accompanied with the possession of great executive ability. He is assisted in the mechanical department by Walter J. Wayte, an engineer of large experience.

The introduction of this industry in our midst is not to be regarded as a matter of experiment, for every phase of the business has been thoroughly examined, and exact calculations made. The extent of the market is known, and the cost of production ascertained.

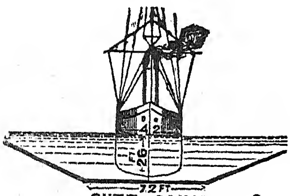
THE MANCHESTER SHIP CANAL.

Visit of Sugar Refiners and Merchants.

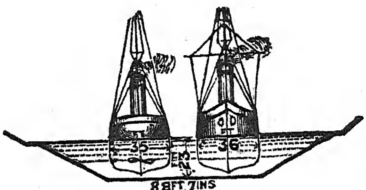
In our April issue we gave a short account of the Manchester Ship Canal, extracted from a lecture delivered by Alderman W. H. Bailey, of Salford (of the firm of W. H. Bailey and Co., Limited, manufacturing engineers), ex-president of the Manchester Association of Engineers. We then stated the proportionate widths and depths of the three great undertakings—the Manchester Ship Canal, the Suez Canal, and the Amsterdam Canal. The following woodcuts will serve to illustrate clearly the proportions of these three waterways.



MANCHESTER SHIP CANAL

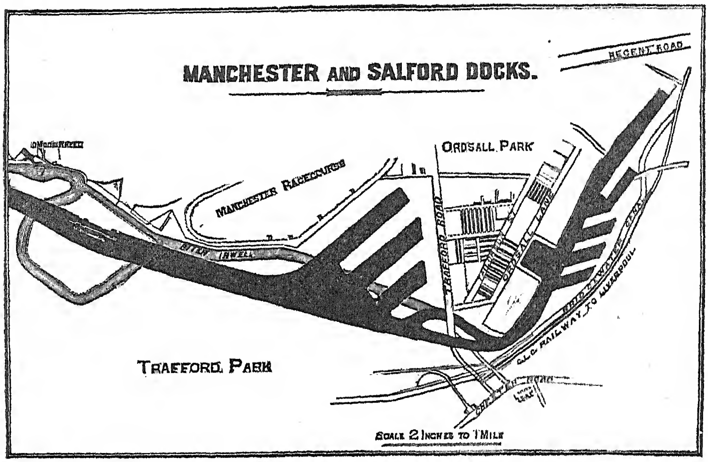


SUEZ CANAL



AMSTERDAM CANAL

The docks at Manchester and Salford will have an area of water space of 114 acres, the length of the quays will be 5¼ miles, and the acreage of quay space, 152 acres. In addition there will be a dock of 23 acres water space at Warrington. The following cut represents the Manchester and Salford docks according to the revised plan sanctioned by Parliament in 1888. The present bed of the Irwell, which is shown in fainter lines, will be filled up.



On the 3rd September a visit was paid to the works of the Manchester Ship Canal Company by a party of gentlemen engaged in the sugar trade. The following were the firms represented—Manchester: Atcherley and Lunt, S. and W. Beresford, Pearson and Rutter, J. Platt and Co., Walter Saxelby, Sharp and Galloway, Kay and Co., Wm. Wilkinson, The Co-operative Wholesale Society, represented by Mr. Bland, of Huddersfield, and Mr. Lobb, of Liverpool; Richard Smith (Messrs. Tewis and Sons); Henry Blore, Ernest Fox, and T. B. Turner. Liverpool: Thos. Bate and Co., H. Clark and Co., Crosfield Barrow and Co., Geo. Crosfield and Co., Farrie and Co., Limited, Thos. Hankinson, S. M. Freeman and Co., Edward Grey and Co., Geo. Jaeger and Son, A. Litherlan Jones and Co., Jas. Leitch and Co., Gustav Meyer and Co., Sankey Sugar Refining Company, Shand, Higson, and Co., Nicholas Waterhouse and Sons, W. D. Heyne, Luzmore and Evans, J. C. Nicholas and A. R. Evans (Messrs. Macfie and Sons), S. Fred. Pilkington (Messrs. Shand, Higson, and Co.) Sheffield: Nicholls and Co., Smith and Carter. Huddersfield: R. S. Dyson, Wallace and Son. York: Terry and Sons. Stockport: Faulder and Co. Oldham: Industrial Co-operative Society. Glasgow: Alexander Hogg and Co., Alexander Orr and Co. Greenock: J. R. Stuart and Co., M'Callum and Lockhead. London: Travers and Sons, Limited. The party left the docks at Pomona at ten o'clock in the morning, and they were conducted over the canal as far as Wilderspool by

Mr. Alderman Bailey, one of the directors of the Canal Company; and Mr. Marshall Stevens, traffic manager.

A few figures relative to the present cost of bringing sugar from Liverpool to Manchester by railway or canal are enough to show that the completion of the Ship Canal should witness an entire revolution in the carriage rates for this commodity. According to the evidence of Mr. Marshall Stevens, given when the Ship Canal Bill was before Parliament, the transit cost of a ton of loaf sugar is 17s. 11d., and of unrefined sugar, 12s. 2d. In the case of loaf sugar 10s. 10d. is absorbed in railway or canal carriage, the remaining 7s. 1d., representing dock and town dues, master porterage, quay attendance, and carting to rail or barge. The cost of bringing the same article to Manchester by the Ship Canal is estimated at 6s. 8d. per ton of loaf sugar, and 4s. 11d. in the case of unrefined sugar. The 6s. 8d. in the case of loaf sugar will include 4s. 2d. canal toll, 1s. landing charges, and 1s. 6d. wharfage. The 4s. 11d. charged for unrefined sugar will include 3s. 4d. canal toll, 6d. landing charges, and 1s. 1d. wharfage. It is, therefore, calculated that in the carriage on the Ship Canal of one ton of loaf sugar a saving of 11s. 3d. will be effected on the present rates, and of 7s. 3d. in the case of raw sugar. On arriving at Wilderspool, near Warrington, the party proceeded to luncheon at the Saracen's Head Hotel.

Luncheon over, Mr. W. Crosfield (Liverpool) said he thought that the most opportune moment for recognising the hospitality they had received at the hands of the Manchester Ship Canal Company. Those present had seen, as he had seen, that a great work was being done. Liverpool people had so far considered themselves *facile princeps* in the matter of shipping. They were frequently told that they had only one sight in Liverpool for strangers to look at, and that was their docks. Certainly the Liverpool docks were worthy of the attention of all strangers, and Liverpool people were justly proud of them. It was said that they in Liverpool would soon have to give place to the older sister—Manchester, owing to the enterprise which she had undertaken with such conspicuous courage. This, however, was a question that future generations must decide. He had no hesitation in saying that the enterprise was unequalled throughout the wide world, and those who had embarked upon it justly believed that it would ultimately be successful. He felt confident he was focussing the opinion of those present when he said that such Manchester men deserved to succeed. Mr. Crosfield concluded by

proposing "Success to the Manchester Ship Canal Company," coupling with the toast the name of Mr. Alderman Bailey.

Mr. Alexander Hamilton (Glasgow) seconded the proposition.

Mr. Faulder (Stockport), who supported the motion, said he could promise that Stockport would do its share towards supporting the Manchester Ship Canal. Large quantities of both sugar and cotton, of which Stockport was a large consumer, would form important additions to the traffic of the canal. Some of his friends in Stockport were hoping that some day the river entering their town would be put in direct communication with the Ship Canal, and were looking to the directors to take the suggestion into serious consideration.

Mr. Alderman Bailey was cordially received on rising to respond. He said it was very gratifying to the directors of the Ship Canal to have such a distinguished body of men, engaged in an important industry, present that day. The Ship Canal was intended to be one continuous wharfage right from Liverpool to Manchester. Last week it was said by a gentleman that Liverpool would really be at the mouth of a funnel leading up to Manchester. There was no doubt about it that sugar might be considered one of the evidences of civilisation. Papermakers asserted that paper was one of the evidences of civilisation, and others that the Bible was, but he was prepared to back sugar. He was somewhat astonished to learn that in the United Kingdom the consumption of sugar was so much more than the consumption of cotton. The tonnage of sugar, he was told, was about 1¼ millions per annum, whilst cotton reached a tonnage of three-quarters of a million, making the total weight of sugar consumed nearly double that of cotton. In fifteen months' time the Ship Canal Company hoped to find many customers amongst the sugar refiners and merchants of the country, and he did not think any one would be able to accuse him of being a false prophet, for the Ship Canal would certainly be finished in the time he stated. Some 2½ years had been occupied in the work so far, and more had been done during that time than in any other undertaking spoken of in history. They had really to get rid of £10,000,000 in 48 months, including canal navigation and purchasing of land. They had seen what had been done in a practical way, and it was a fair sample of what Manchester men were capable of. A German writer had said that civilisation was the economy of force, and that English force was coal. It was a great mistake to think that coal was the great force

of our civilisation. The spirit of the race was the great lever in English civilisation; it was the Englishman's bold pluck, his audacity, genius, and daring. As to the matter of pounds, shillings, and pence in propelling power after the canal was made, or the cost of carriage per ton per mile as compared with other inland methods of conveyance, these were items which practical commercial men had already settled. It had been conclusively proved that it was a great deal cheaper to send goods by canal. When once the canal was made the management would have little to do beyond sitting and receiving toll. The engineers were doing their work so well that the maintenance of the canal would be a matter of small moment financially. The stonework seemed to be built for fortresses, and intended to defy the hand of time. It gave him the greatest pleasure to see traders engaged in various commercial pursuits visiting the Ship Canal. What the directors wanted was to obtain publicity, and to let the people know that the waterway afforded the best and most economical way of getting commodities to and from the various markets under the most economical conditions.

Mr. MARSHALL STEVENS remarked that the Ship Canal would make Manchester the nearest port to a population of more than seven millions, or one-fifth the population of the United Kingdom. It was not Liverpool the promoters of the Ship Canal sought to compete with, but the ports on the east coast. At Partington the Ship Canal would be nearer than Hull to the South Yorkshire coalfield. Manchester would also be nearer Wolverhampton than any other ocean steamer port, and the same remark applied to many other towns in the east, north, and south. Estimated at the rate of 70lbs. per head, the consumption of sugar amongst the 7,000,000 of people living in the vicinity of the Ship Canal would be equal to 218,000 or 220,000 tons a year. It had not been stated that the Ship Canal Company ever thought of getting this quantity of sugar sent over their waterway, but a gentleman who knew anything of the subject would hesitate before he would say that this quantity would not be sent over the canal in five or ten years. Comparison of the traffic rates was only necessary to show what the Ship Canal would do in this direction. To-day it cost 17s. 11d. to get a ton of loaf sugar from Liverpool to Manchester; and the consequence was that no loaf sugar was sent that way, but it came through to Manchester *viâ* Goole, Grimsby, and Hull. The charge for carrying a ton of sugar down the Seine from Paris to Rouen, a distance of 85 miles, as compared with 32 from Liverpool to Manchester, was only 5s. 7d. The same figures applied also to fine sugar. In this department of trade the Ship Canal would offer exceptional facilities of carriage for refiners and merchants.

DIFFUSION *v.* MILL-WORK.

A paper by Dr. Dannenmann, which lately appeared in the *Louisiana Planter*, although evidently written with a strong basis in favour of diffusion, concludes by admitting that the phenomenal success attained in the Hawaiian Islands had not hitherto been reached in Louisiana. The closing remarks of the paper seem worthy of reproduction as affording a contribution to the discussion of the as yet unsolved problem, whether diffusion or millwork is the best. We therefore reprint it in full, as follows:—

It is claimed on the part of mill adherents that the large dilution necessary for thorough extraction with diffusion, increases the expense of fuel in evaporation of this extra dilution. This extra amount of steam necessary is almost wholly offset by the small amount of steam required to run the light machinery of a diffusion plant in contrast to the ponderous and prodigious mill outfit, and, moreover, the recent improvements in evaporative apparatus, for instance, the multiple effect, or triple effect evaporate as high as 60,000 gallons of juice in twenty-four hours, and thus the evaporative power of a sugar house is equal to the extraction, whilst steam in great excess is not necessary.

It has been proven that by diffusion we can obtain from 12½% to 15% juice extraction in excess of what can be obtained by the best extraction of the best mills, even where maceration is practiced by the mill, which is, by the way, a modified form of diffusion. So that a planter who obtained 3,000,000 pounds of sugar by the mill would obtain 350,000 pounds of sugar by diffusion, a gain of 450,000 pounds of sugar at 5½ cents per pound, equals $24,750; a fact, which when realized need not be further extolled with grandiloquence of words and differentiation of advantages and remunerations to influence speedy adoption of this method.

Another feature is, as I have said before, that it is even more profitable to the small planter than to the large, because it is impossible to obtain as thorough extraction with the light metal of a small concern, and at the [same time the diffusion works equally effective whether small or large.

The burning of the chips has been a moot point for a long time, but this obstacle to successful operation of diffusion was this season surmounted, and the feasibility of this operation was demonstrated without peradventure.

There remains no barrier to the universal adoption of diffusion, other than the first cost of the battery and the loss sustained in disposing of the costly mill machinery, and no progressive and thoughtful sugar planter will allow himself to neglect this golden opportunity which the child of science and necessity offers. Never more in the history of sugar making was it of so eminent importance to obtain larger quantities of sugar than at the present time, as the Republican Congress threaten to cut the sugar tariff 1 cent a pound, arguing that we are producing a mere fragmentary portion of the total consumption of this country.

Now, while I do not propose to enter into the political side of this question, suffice it to say that the best argument in favour of the sugar industry is to produce *prima facie* evidence that it can and will produce every pound of sugar necessary for home consumption. Then can the claim for protection on an equality with other industries be sustained without recourse to apology and excuses for inadequate supply and for attributed benefaction to a few.

To summarize, I will briefly state the various advantages of diffusion over any other process of extraction known. 1. The most thorough extraction and that as I have illustrated, of the crystallizable principles of the cane, 200 pounds of sugar is an average for a season's run, and that with the numerous defects of untried machinery, the stops and delays causing loss and expense, contingent with improperly constructed apparatus is compared with the fact that not 5 per cent. of the mills of this state exceeded an average of 150 pounds per ton, a balance in favour of diffusion of 50 pounds of sugar at 5½ cents per pound, equals $2·75; deduct from this, say 25 per cent. for extra cost of fuel and labour 70 cents, leaving a net gain per ton of $2·05, which means to the planter working 10,000 tons of cane, a gain of $20,500, almost the full returns in one season for the erection of a diffusion battery.

2. The most simple and thorough clarification possible, the neutralization and precipitation by lime in the cells and the filtration performed mechanically by the chips, thereby obviating undue and derogatory subsequent treatment and exposure, etc., operations which subject the juice to potent inverting agents and the possibilities in the near future of improving cell clarification so as to immediately run the juice into the triple effect for evaporation without further treatment; and

3. The reduction in expenses of manufacture concomitant with the above improvements. While not all diffusionists are equally successful as regards fuel economy, yet there are some plantations that are using the chips as fuel; of course I refer to those which have natural water advantages. But the fact serves a double purpose, *i.e.*, that diffusion chips can be serviceably used as a fuel, and that all improvements tend to a reduction of fuel consumption, and while there is a slight increase in labour necessary, the cost is but a small per cent. of the excess of yield.

4. Again, while the sugar produced is just as good as by the mill, yet greatly in excess, there is no danger of the terrible breakdown that makes the hours of grinding season periods of anxiety and fear to the planter, that any moment he may be called upon to witness the wreck and ruin of all his prospects and his energy, time, and money, spent in the vain hope of replenishing his already depleted resources. But while these mishaps are not always so disastrous, yet they are expensive, and cause the loss of many hundreds of dollars. The total immunity from such losses by diffusion can only be appreciated by one who has passed through the mill, or, in other words, experienced the consequent results in trying to do first-class crushing on dry, hard rations, and who has broken his rollers by it.

5. Last, and not least, remains the fact that among the diffusion enthusiasts are the most progressive and educated of the sugar planters of this and other states, and that not one of those who have diffusion plants regrets the change, but is willing to make further outlay in completing his machinery, and who does not become more and more convinced of its merits and advantages as he becomes thoroughly acquainted with it.

THE DIFFUSION CHIP PROBLEM.

There appears to be a growing opinion among practical gentlemen that, after all, it is possible that it will be better to abandon the attempt to *burn* diffusion chips, and to utilize them, instead, as a *fertilizer*. It will be remembered that at the outset Dr. Stubbs, from his chemical standpoint, strongly advised their return to the soil, arguing that increased production of sugar thereby gained would more than pay for extra cost of fuel.

Somewhat to our surprise, we found that one of our leading New

Orleans machinists entertains similar opinions, although he builds diffusion machinery. He says "certainly, diffusion chips can be burnt, but it will cost a great deal to do it." He thought a practical method of drying, for fuel, might be employed, or better still, they be hauled to the field in their wet condition.

About the same time, we met the veteran and practical planter, Mr. P. E. Beauvais, of Barrataria, Jefferson parish. He is a warm advocate of the diffusion process, but from the first has been opposed to burning the chips, believing that they are too valuable as a fertilizer. He has even made some experiments with mill bagasse (harder to subdue than the finer diffusion refuse, and with much acid in it), and yet, when placed on the land, California yam potatoes can be grown on them the first year, which send out such a mass of leaves that all grass and weeds are killed, and the second year cane does remarkably well, when planted in the open bagasse beds. He says that there is such an amount of heat generated by the decaying mass, that for three crops the cane will never cease to grow—even in winter. That is the secret of the successful growth of cane on timber lands—it has the warmth of the humus which it gets the same as from decaying bagasse. Besides, the soil is thus being renewed by the application. Mr. Beauvais says that, after all, cane *is* "a hot house plant," and when so treated, by a mass of decaying vegetable matter, it is in its normal condition. We believe most planters will assent to this proposition.

Diffusion chips can be taken to field, says Mr. Beauvais, by means of cane cars (which every well-equipped sugar plantation should have), and it will not be a difficult matter to load the chips on the empty cars, as they return to the field for cane, and the mass could be dumped by the track in the field, and applied where wanted after the hurry of sugar making is over.

The above proposition appears to be practicable; we all know that for one or two seasons Gov. Warmoth hauled his diffusion chips to the river, by cane cars, and dumped them in the water! Why not so arrange that the chips can be discharged direct on the cars for fertilizer? Such was the original plan of Gov. Warmoth, but owing to mechanical defects he abandoned the scheme. If our mechanical engineers will turn their attention in the direction suggested, they may do an immense service to the sugar industry.—*Louisiana Sugar Bowl.*

IMPROVED VALUE OF SUGAR IN DEMERARA.

From the Report of the Botanic Gardens at Georgetown, 1890.

With regard to the improved value of sugar I extract from the Report of the Comptroller of Customs the following comparative statement of the past six years. Two years of the time it will be observed that the crop was materially greater, and only one was it very materially less, than last year, yet not since 1884, has the value been as great:—

Exported.	Packages.	Value. dols.
	1884.	
Sugar	139,246 hhds.	8,750,225 30
Rum	33,400 puns.	1,202,450 00
Molasses	12,854 casks.	231,372 00
Total		10,184,027 30
	1885.	
Sugar	106,731 hhds.	6,647,255 95
Rum	28,353 puns.	992,366 66
Molasses	10,362 casks.	165,792 00
Total		7,805,414 61
	1886.	
Sugar	124,283 hhds.	6,997,156 36
Rum	24,773 puns.	737,264 23
Molasses	20,001 casks.	267,663 38
Total		8,002,083 97
	1887.	
Sugar	149,860 hhds.	8,633,461 00
Rum	24,939 puns.	670,387 50
Molasses	19,066 casks.	212,204 58
Total		9,516,053 08
	1888.	
Sugar	120,135 hhds.	7,712,114 47
Rum	14,074 puns.	446,969 06
Molasses	26,604 casks.	353,325 12
Total		8,512,408 65
	1889.	
Sugar	128,430 hhds.	9,187,891 14
Rum	18,093 puns.	796,099 33
Molasses	22,782 casks.	316,897 62
Total		10,300,888 09

SUGAR CULTIVATION IN INDIA.

Correspondence on the subject of sugar cultivation in India has lately been published in the *Kew Bulletin.* In order to arrive at some practical conclusions in regard to the correspondence, the papers were placed in the hands of Mr. C. B. Clarke, F.R.S., late of the Bengal Educational department, whose remarks on their contents may be thus summarised:—Mr. Clarke remarks that the statement contained in the correspondence that the difficulty with the sugar cane industry in India is the limited supply of rainfall is not correct. He goes on to say:—

In all Bengal proper (*i.e.*, excluding Behar) the rainfall is at least 70 inches a year, spread from 1st April to 31st October, and I never saw in that area sugar cane irrigated in my life except (rarely) a little water-pot work at starting. The "comparatively limited areas in East Bengal with a moist climate" mentioned in paragraph 7 of the Government of India's letter include nearly all Bengal from Calcutta to Dinagpore and from Burdwan to Commilla, an area enough to raise all the sugar used in the world. The ordinary soil of Bengal, sand and clay in various proportions, suits sugar cane very well, and it is often seen on the very margin of a *bheel* without injury from waterlogging. The causes why the natives do not grow sugar more successfully, as set out by Mr. Goodridge are correctly stated, but there are others. In Bengal sugar cane is often in half acre plots, it does not pay the cultivator to watch so small a piece, therefore every boy, every gharry-wallah, who passes takes a few canes and every elephant takes many. Gross robbery is also frequent. These small plots are very frequently thus half destroyed before being cut. I have seen them wholly destroyed. In plots of 100 acres the per centage of loss from this cause would be insignificant. Sugar cane can be grown any where in Bengal proper without irrigation. The Crop is of course greatly helped (when rain is short) by manure and deeper cultivation. Of all crops that Europeans, even amateurs, attempt in Bengal, I have noticed none in which they succeed so well as with sugar cane. Their deeper cultivation, manuring, and more careful weeding, tell upon sugar cane. In several cases missionaries have spoken to me in suprise of the enormous profits they have obtained from a few acres of sugar cane. In the present reports the sugar cane crop is said in India, to average 6*l* an acre; so that it will

pay for "high" cultivation. As to the advice given to the government to bring a Mauritius or West Indian planter to grow sugar cane for them in Bengal, I think any European gardener in the Bengal service fully competent to grow sugar cane there, probably more competent than a stranger who understands neither the language nor the people. The chief difficulty of unskilled Europeans in raising sugar cane is the procuring of good tops for setting. As to the white sets of Mr. Goodridge, they are fearful in Central India, troublesome in Chota Nagpore, unimportant in Bengal. I agree with Mr. Goodridge, that it is not possible to introduce large culture by the aid of native cultivators or of native capitalists. If Government is to attempt its introduction, it must be by Europeans. Many opportunities have occurred for trying the experiment at small cost. The European gardeners, Mr. John Scott and others, have observed to me that if it is wished that their efforts should be profitable, Government should set them to work to grow sugar cane, *khejoor* (*Phœnix sylvestris.*)

The correspondence is accompanied by a despatch and resolution from the Viceroy's Council on the subject addressed to the Secretary of State for India, in which it is stated in reference to certain proposals submitted to the local authorities that "We are inclined to attach much confidence to the views and conclusions formed by Messrs. Thompson and Mylne, who have paid, for many years, practical attention to the subject of sugar cultivation and manufacture by ryots, and were the first to introduce the portable sugar mills which have now spread over India. They advocate the gradual improvement of the ryots method of manfacture, rather than the introduction of more expensive and centralising systems. The provincial departments of agriculture have of recent years directed attention to this question and may usefully be desired to continue to do so. We are also willing to advocate the establishment of agricultural experiments in those comparatively limited tracts of the country (such as Eastern Bengal, where there is a moist climate and a more or less abundant supply of manure) in which the Mauritius methods of cultivation have *primâ facie* some prospect of success, and we are prepared to advise our local Government administrations to give every reasonable support to sugar factories and refineries which may be established by private enterprise."—From *the Tropical Agriculturist.*

In connection with the subject of agriculture in India the Journal of the Society of Arts has published the following letter:—

"In the first place it was very evident that Mr. Robertson like many people who have not been directly connected with British administration in India, had a very crude idea of our position as landlords. We derive a large proportion of our revenue from the land-tax, and can sell a man's tenant right if he does not pay the dues of the State, but we can do so for no such cause as his not manuring his land according to our notions or making use of that rotation of crops which we may consider scientifically correct. It is one of the privileges conferred on the ryot in any revenue settlement that he can do anything he chooses with his fields as long as he pays the revenue. No one will for a moment deny that proper rotation manuring (no in all cases), irrigation, &c., are very advisable both for the ryot himself and to increase general prosperity, but he must adopt them of his own accord, guided, if possible by the collector's advice but in no case on the order of that officer.

The only really practical way suggested by Mr. Robertson in which agriculture in India can be advanced by the action of the State, beyond providing improved facilities for irrigation and good communications, is in the encouragement of small local works such as village tanks and wells in fields and improved methods of drawing water from such works. If there were a tank, under which rice or sugar cane could be grown, in every village, and a well, from which he could raise an irrigated crop, in every man's field, in case of failure of the monsoon rain, we might defy all future famines. I am quite aware that this policy has not been lost sight of for great facilities are afforded individual ryots to take up loans, at moderate rates from the State for the improvement of their lands on the security of the latter, in addition (at all events in Bombay) to the full value of such improvements being secured to them by law in perpetuity. These facilities have, however, not been taken advantage of by the ryots to the extent which might have been expected, on account of their dislike to submit to be bound by the formalities with which the State has necessarily to protect itself against loss in making the loans. Discouraging as this is the efforts made in this direction must not be relaxed, and it is to be hoped that by degrees if all unnecessary formalities are carefully dispensed with, a more general recourse will be had to such land to the benefit of the individual ryot and State."

The remainder of the letter is devoted to the question of manure and of the education of the ryots in agricultural science.

SUGAR BEET CULTIVATION IN BRITISH COLUMBIA.

Sugar Beet Cultivation.

As early as 1867 this subject occupied attention in California. In 1869 a company, with a capital of $250,000, was formed to test the matter. In 1870 the Alvarado was built; a crop was put in, and the factory started in November. The capacity was fifty tons per day. The first year $18,000 was made, but the next, owing to the low prices, there was a loss, and the factory was removed to Santa Cruz, where it was quite as unsuccessful, owing in a great measure to heavy expenses. The Alviso factory was started, and ran successfully until 1887, when it was destroyed by fire.

From 587,000 pounds in 1871 the production increased to 1,500,000 in 1872, and to 1,688,285 in 1886. The consumption of sugar in the United States is about 1,300,000 tons a year, and increases at a rate of 134,400,000 pounds a year. Sugar beets can be produced at less cost than in Europe, and are richer in saccharine matter. No fertilizing is needed, and less weeding is necessary. A factory to consume 350 tons of beet every twenty-four hours would cost about $400,000. The requirement is that 2,500 acres shall be planted every year; a site of thirty or forty acres must be supplied; it must be near a railway. Cost of seed $1·80 to $3·00 per acre. Such a factory would produce 35 tons of sugar per day, or say 7,000 tons in 200 days, which would be about its running season.

At Alvarado factory in 1884, 516,354 tons of beets produced 29,673·5 tons of sugar, taking nearly 17 tons of beets per ton. For the beets $4·50 per ton were paid, say $73,593; for the sugar 5¼ cents per pound, or $113,782·55, leaving about $40,000 for expenses and profit, and it is claimed that much expense could be saved in the manufacturing.

Good California land produces 25 to 30 tons of sugar beets to the acre, yielding 10 per cent., the greatest known yield. At $4·00 to $4·50 per ton, farmers would gross $100 to $135 per acre.

To the above figures might be added offal, which has been known to reach to about as much as 25% of the whole production.

In addition to good returns to the farmers, the industry gives employment at the rate of one man to every 30,000lbs. of sugar produced. Then the barrels to contain the sugar would require hands in manufacture, the 2 per cent. slacked lime used in making the sugar, the coal consumed, and everything in connection with such an industry,

would create necessities for the employment of help. On a basis something like this, the above sugar can be produced at 4·84 cents per pound; and it is asserted that it might be made to cost considerably less, some claiming as low as 3½ to 4 cents.

Now all the above-stated can be safely said also for the province of British Columbia, and in particular of the agricultural lands in proximity to Vancouver, where all the product could be disposed of.

Let us then recapitulate:—The cost of beet seed will be about 12 cents per pound. It takes from 15 to 25lbs. to sow an acre. This makes the cost from $1·80 to $3 per acre for seed. The average yield per acre of sugar-beet is from 25 to 30 tons, yielding in sugar 10%. In 25 tons there will be, say, 2½ tons, or 5,600lbs., refined sugar per acre. Price for sugar-beets is $4 per ton; prices ranging according to the percentage of saccharine matter the beets contain. This will give from $100 to $120 for the gross yield of land planted in beets; whereas wheat at 50 bushels to the acre would only yield at $1·00 $45, which would be an increase of $55 to $75 per acre over the profits obtained on wheat. Assuming the cost of both to be the same, with a very small farm a man would easily secure a good income, as 40 acres would give a net profit of $2,200.

I should judge the estimated area of lands from Harrison River to the Pacific coast to contain, capable of beet culture, about 400,000 acres, at $100 per acre—$40,000,000 as returns to the farmers.

Besides this return, the industry gives steady employment to 40,000 men, representing a population of about 280,000, including traders, manufacturers, wives and children; and it would further support many other industries, and the population incidental thereto.

British Columbia Sugar-beet Analyses.

Chemical Laboratory, 8, Clyde Street,
Edinburgh, 9th November, 1888.

Analyses of sample of sugar-beet, sent by the Mayor of Vancouver to Mr. William Clark, Canadian Court, Exhibition, Glasgow, received here 6th inst.:—

Moisture	77·14
Sugar....	13·80

This sample consisted of three well grown sugar-beets. They contain nearly 14% of sugar, which is considerably above the average of sugar grown on the continent of Europe. The choice of seed has much to do with the amount of sugar contained in the roots, and with

careful selection beets have been grown containing as much as 17% of sugar, but the average produce is from 10 to 12%.

These sugar-beets may have dried to some extent. Probably the original percentage of water would be about 80. If so, there would then be about 13·3% of sugar in the fresh beets.

A. P. Aitken,

Chemist to the Highland and Agricultural Society of Scotland.

Alvarado (California),

September 27th, 1888.

Beets from British Columbia.

	Sacchr.	Sugar.	Diff.	Quot.	Value.
Small beets.. ..	19·80 ..	16·31 ..	3·49 ..	83·4 ..	13·60
Medium beets ..	18·90 ..	15·53 ..	3·37 ..	82·2 ..	12·76
Large beets.. ..	16·50 ..	13·40 ..	3·10 ..	81·2 ..	10·88

The beets designated as "small beets" were the smallest in the bags. Really they are not what we would call a small beet, as they are the proper size for sugar-making. The term "value" shows the amount of available sugar in the juice.

We consider all the above very good; they all were higher than the average German beets.

Edw. P. Dyer.

Vancouver, B.C., September 27th, 1888.

His Worship the Mayor of Vancouver, B.C.,

D. Oppenheimer, Esq., City Hall.

Dear Sir,—I have the honour to report on the samples of experimental sugar-beetroots handed me for analyses on the 15th instant.

My selection was made from beets ranging from a half-pound to three and a half pounds in weight; and in order to obtain a thoroughly reliable and unflattering proof of the quantity of the sugar available for manufacture, I made two separate analyses—the first one of roots over average size and weight; the second of such of a size below medium and of low weight—which furnished the following results:—

LARGE SIZE.	Per cent.	SMALL SIZE.	Per cent.
Water	83·7	Water	81·6
Gluten	2·9	Gluten	3·1
Fibre	3·8	Fibre..	4·8
Sugar	9·2	Sugar	10·2
Waste	0·4	Waste..	0·4
	100·0		100·0

According to the above scrupulously-obtained analytical statement, the smaller roots practically yield the greater percentage of sugar available for manufacture; while on the other hand (as by analysis rendered), the larger-sized beets are of more value, on account of the higher quality of the contents.

I herewith beg to hand you samples of sugar produced, and think that I may safely recommend the propagation of a sugar-beet cultivation in British Columbia, the analytical results being, according to my own extensive experience, above the average in comparison with the growth of various other countries.

DR. P. HERBING,
Analytical Chemist.

Medical Hall, Vancouver, B.C.,
December 8th, 1888.

His Worship Mayor D. Oppenheimer,

Dear Sir,—I have the honour to submit herewith my analytical report on four different kinds of sugar-beetroot, handed to me on the 8th of November, and respectively marked German No. 4, German No. 5, German No. 6, and Imperial Rose. From the samples, which were well matured, and consequently furnished better results than those furnished in September last, I took large as well as small specimens, and analysed them separately, with the subjoined favourable effect:—

German No. 4.—A sound beet with reddish skin, the flesh changing towards the centre into a yellowish hue. Large size, 10·2% saccharine matter; small size, 9·7% saccharine matter.

German No. 5.—Skin pink, flesh of a pale yellowish pink, turning to a bright yellow near the centre. Large size, 10·9% saccharine matter; small size, 11% saccharine matter.

German No. 6.—Skin pink, flesh white.

	Large Size.	Small Size.
Sugar	11·8	11·6
Fibre	2·9	4·6
Water	82·0	80·5
Gluten	3·0	2·8
Waste	0·3	0·5

Imperial Rose.—Skin reddish, flesh pink.

	Large Size.	Small Size.
Sugar	12·2	11·8
Fibre	3·0	3·8
Water	81·5	81·9
Gluten	3·1	2·3
Waste	0·2	0·2

The best, viz., German No. 6, promises, if properly treated with saltpetre manure, a more advantageous result, on account of its rich percentage of fibre and gluten.

Apparently all the four kinds have been raised in a soil which is entirely free from alkali admixture and manure.

DR. P. HERBING,
Analytical Chemist.

REPORT OF THE SUGAR EXPERIMENT STATION OF THE LOUISIANA STATE UNIVERSITY AND A. AND M. COLLEGE, AT AUDUBON PARK, NEW ORLEANS, DA.

WM. C. STUBBS, Ph.D., Director.

(Continued from July number.)

By an unfortunate oversight, attributable mainly to superabundance of matter for the last two issues, we omitted to continue our extracts from the above highly interesting report. Experiments have been conducted for four years as to the necessity of nitrogenous manures, the result being that it is evident that the soils of that district require nitrogen to grow maximum crops, as is clearly shown by the constant increase given by the nitrogen mixtures used over the results derived from no manure or mixed mineral manures. These nitrogenous manures were cotton seed meal, fish scrap, dried blood, sulphate of ammonia, and nitrate of soda. Experiments continued during three years also showed that phosphoric acid is needed to grow full crops, but not as urgently as nitrogen. "The form of potash used in moderate quantities was productive of apparent good." A portion of one plot was devoted to the trial of certain formulas hitherto supplied to the public as being adapted to cane, viz.:—

"No. 1, consisting of—

130 pounds nitrate of potash,
650 pounds acid phosphate,
510 pounds gypsum,

is prescribed by Prof. George Ville, of the government school at Vincennes, France, as specially adapted to plant cane. It is an expensive compound, and experience here has shown it to be excessive in phosphoric acid and deficient in nitrogen.

"No 2 is a formula prescribed by the Experiment Station upon St. Denis, on the island of Reunion (formerly Bourbon), and is highly endorsed by the planters of this island and Mauritius. It too is

expensive, and the quantity per acre much in excess of the ordinary requirements of our crops. It is as follows:—

140 pounds sulphate of ammonia,
100 pounds nitrate of soda, 120 pounds dried blood,
560 pounds acid phosphate,
80 pounds muriate potash.

"Here the nitrogen is presented in three forms, which is believed to best meet the requirements of the plants.

"Nos. 3, 4, and 5, which were fertilised in 1888 respectively with Ohlendorff's 'A' Special Cane Manure, 'B' Early Cane Manure, and 'C' Dissolved Peruvian Guano, were this year as stubble, in default of these manures, treated with the following mixtures:—

"No. 3—
720 pounds cotton seed meal,
500 pounds acid phosphate,
320 pounds kainite.

"No. 4—
720 pounds cotton seed meal,
500 pounds acid phosphate,
80 pounds muriate of potash.

"No. 5—
720 pounds cotton seed meal,
500 pounds acid phosphate,
80 pounds sulphate potash.

"The following table shows the yields of 1888 and 1889:—

		1888. Plant.	1889. Stubble.
1. Ville's Formula	Yield per acre	26·01	15·65
	Sucrose	13 2	11
	Glucose	·84	1·31
	Pounds available sugar	4,357	1,979
2. St. Denis Formula	Yield per acre	30·05	21·56
	Sucrose	13·1	10·9
	Glucose	·9	1·32
	Pounds available sugar	4,943	2,692
3. Ohlendorf's Special Cane Manure in 1888 Meal phosphate with Kainite in 1889	Yield per acre	29·16	20·82
	Sucrose	11·7	11·2
	Glucose	·9	1·22
	Pounds available sugar	4,225	2,731
4. Ohlendorf's Early Cane Manure in 1888 Meal Phosphate with Muriate Potash in 1889	Yield per acre	24·73	19·13
	Sucrose	12·4	11·4
	Glucose	·91	1·47
	Pounds available sugar	3,825	2,462
5. Ohlendorf's Dissolved Peruvian Guano in 1888 Meal Phosphate with Sulphate of Potash in 1889	Yield per acre	22	20·88
	Sucrose	15·7	10·9
	Glucose	·85	1·22
	Pounds available sugar	3,527	2,651

"The St. Denis formula has furnished the largest tonnage each year, while No. 3 has given this year the largest sugar yield. The fertilisers used in Nos. 3, 4, and 5 are far cheaper than those prepared by the foreign formulas, and give equally as good results. Ville's formula is deficient in nitrogen and excessive in phosphoric acid, while St. Denis is excessive in both; both nitrogen and phosphoric acid in Nos. 3, 4, and 5 were greatly in excess of requirements last season, this being an unusually dry one."

It is noteworthy that the conclusions reached at Audubon Park with regard to the comparative value of certain artificial manures tally almost exactly with the experience of the Dodds Botanical Station in Barbados, as detailed in our July number, viz., that the Ohlendorf manures are to be preferred to all others hitherto tried for productiveness combined with cheapness of cost.

Correspondence.

To the Editor of "The Sugar Cane."

Sir,—In an article on Sugar Bounties in your last issue you state:—

"Now that the time for special pleading has gone by, and we have "to look matters squarely in the face, we are of the opinion that the "perfection in cheap production of sugar, which has been reached by "at least the German manufacturers and agriculturists, and which "is fast being attained by the French, would still have enabled them "to supply sugar in Europe, and probably in America, at a price "sufficiently below the cost of production in our colonies to put them "in a position to hold their ground."

It would, I feel sure, interest a very large section of your readers if you would give them the data upon which this opinion has been formed, as the relative cost of beet and cane sugar production is of the highest importance to all who are engaged in the production of either the one or the other.

I have myself probably taken as much trouble as any one to arrive at some conclusion in regard to this all important subject, and the opinion I have formed, although with considerable diffidence in view of the great complexity of the problem, is materially different from that which you enunciate.

In regard to cane sugar we may practically regard the old muscovado system as being at an end. In Cuba and the West

Indies, Brazil, Mauritius, Java, Queensland, and other large cane sugar producing countries, modern machinery has almost entirely supplanted the old process, and in the coming struggle between cane and beet, cane will be armed with the weapons which have enabled beet to ruin the muscovado industry.

My own belief is that at the present time there is very little, if any, difference in the cost of production of a ton of beet sugar and a ton of cane sugar, but a ton of cane sugar is worth fully £2 more than a ton of beet. Again, it appears to me that the cost of production in the case of beet sugar is increasing, in consequence of the rise in wages which is going on throughout Europe. On the other hand there are few cane sugar estates which are not steadily reducing their cost of production.

I remain, Sir,

Yours faithfully,

N. Lubbock.

London, 3rd September, 1890.

SEEDLING CANES.

To the Editor of "The Sugar Cane."

Attention has recently been directed to the efforts which have been made from time to time to raise sugar canes from seed, and some notice was taken by yourself of my feeble efforts in this direction. It was chiefly during the years 1865 and 1872, that I made many enquiries from experienced planters and botanists when visiting the West Indies, and having obtained some of the very fine seed of the plant under exceptionally favourable circumstances, I sent it to Kew Gardens, where efforts were made to induce germination.

My request not only met with prompt attention, but I received several letters (if my memory serves me) from Mr. Oliver, but the efforts made proved *wholly unsuccessful.*

Many persons probably made the attempt before me, and many others have endeavoured to propagate the cane in this manner since. The subject is of interest, and your magazine would offer a field for collecting information which may be of infinite value to the important planting interest.

Yours truly,

Alfred Fryer.

(See our remarks at the bottom of page 486, in our September number.—Ed. *S. C.*)

JAMAICA.

To the Editor of "The Sugar Cane."

Sir,—Jamaica, like all the other British West Indian Colonies, has experienced great vicissitudes of fortune. It, like its sister colonies, is still struggling with difficulties by reason of the unfair competition to which it is subjected, owing to the bounties given by the executive of continental nations to the growers of beet sugar. The competition has already caused several of the colonies to cease to be considered as exporters of cane sugar. Of the Windward Islands we can hardly consider St. Vincent, Grenada, or Tobago as producers of sugar. Some of the Leeward Islands are in the same condition, and unless a better permanent price than that now ruling for sugar be obtained, it is to be feared that the British sugar dependencies in the West Indies will be reduced to Barbados, Trinidad, and Demerara. Antigua, St. Kitts, and Jamaica may hold out for some time longer, but the returns from these show a very small total of hogsheads exported, as compared with their export in the time of slavery. Jamaica, before the emancipation of the African bondsman, exported 130 to 135,000 hogsheads of sugar. The export to-day is about 30,000 hogsheads. This diminution of her wealth was not, however, altogether caused by the freedom of her labourers, but by the admission of slave grown sugar on the same terms as free labour sugar. That admission was the last straw that well nigh broke the camel's back. I have before me a copy of a paper read by Sir Anthony Musgrave, in 1880, to the members of the Royal Colonial Institute. He gives the number of sugar estates at that time in cultivation as 228. By the Handbook of Jamaica for 1888-89, I see the number in cultivation in 1887 was 178, making a decrease of 50 estates in seven years. According to the Handbook, the total number of hoghsheads of sugar exported in 1887 was only 25,604 hogsheads. Coffee, too, had fallen from 84,032 cwts. in 1878, to 56,587 cwts. in 1887. Happily her minor industries have increased in value, but it is to be feared that, so long as the sugar industry is depressed, Jamaica will never hold that position among the West Indian Colonies to which she is entitled by her extensive area, and her past achievements. To show how terribly she suffered after the emancipation of her slaves and the admission of slave and free made sugar on the same duty terms, I quote the following extracts from a letter written in 1850, after his visit to

Jamaica, Trinidad, and Demerara, by the Hon. E. Stanley, M.P.—the present Lord Derby—to the Hon. W. E. Gladstone, M.P.:—

"Mr. Hosack, one of the most skilful and experienced planters in the Colony of Jamaica, stated at a public meeting,—'Our position is much worse than that of the British farmer, and totally different. It is enough to state that out of from *forty* to *fifty* sugar and coffee estates in St. George, I could name about *six only* which are going on vigorously at this moment, and those, too, mainly with the help of captured Africans; whilst by far the largest number are totally abandoned, with buildings in ruins and fields in jungle.'"

"I heard that Cherry Garden Estate, in the parish of St. Andrew, netted in times of slavery, in one year, £11,000 sterling. Mr. Gordon bought it five years ago for £1,650 sterling. It would now bring at most £800."

"The Rhine Estate, in St. Thomas in the East. This property was sold at no remote period for £50,000. Mr. Gordon bought it about two years ago for £4,200. The Rhine would now bring about £2,000."

I could make further quotations from the letter showing the disastrous consequences which followed on the admission *of slave made sugar into the British market* on the same terms as free labour sugars, but they would make my letter too long. I conclude with one other quotation. The Earl of Derby, when Lord Stanley, wrote thus:—

"Who doubts that, if in 1833 a single individual in either House of Parliament had hinted a doubt that slave grown sugar might hereafter be admitted on equal terms with our own, we should have had pledges given, promises lavished, the good faith of the Government appealed to, and with these promises and pledges would have been mingled no little indignation, and many taunts and sneers at the unworthy suspicion of which ministers had been made the object?

"To say that no guarantee was offered is only to affirm that none was asked, that no suspicion was entertained that Parliament for once was unanimous, and that in the continuance of that unanimity, the colonists perhaps unwisely confided."

The letter of Lord Stanley gives a similar deplorable account of the destruction of property in Trinidad and Demerara, brought about by the same causes.

It is well that your English readers should be made acquainted with the past injustice that the sugar producing colonies have suffered

at the hands of the mother country. Possibly such acquaintance may induce them to assist in removing the injustice under which they are now suffering by the beet sugar bounties. Mr. Gladstone has stated that they are based "on folly and injustice." Then why not try to rectify the injustice? "The mills of God grind slowly, but they grind exceeding small." Too great a dependence on beet may some day bring famine prices for sugar. A severe drought, or a lengthened fall of rain might so diminish the supply, that the price of all kinds of sugar would be double what they are at present.

Your obedient Servant,

W. H. Jones.

2, Vermont Road, Upper Norwood,
22nd September, 1890.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

12190. J. L. Corbett, Glasgow. *Improved automatic boiling apparatus.* 5th August, 1890.

12272. L. May, London. *Apparatus for moulding sugar to the form of sticks or bars suitable for cutting into cubes.* 6th August, 1890.

12635. H. H. Lake, London. (Communicated by Lothar Sternberg, United States.) *Improvements in sugar refining.* (Complete specification.) 12th August, 1890.

12729. H. Cumber, Guernsey. *A compound of sugar with the salts of phosphorus for dietetic purposes.* 14th August, 1890.

12868. T. Moore, Glasgow. *The moulding of sugar and material or compositions for sweetmeats, and for stamping, embossing, or printing material or composition for sweetmeats.* 16th August, 1890.

13029. R. W. James, London. (Communicated by E. J. Tobin, representative of and for the firm of Holdsworth, Macpherson & Co., and Thomas Davidson, Australia.) *Improvements in filters and filtering apparatus.* 19th August, 1890.

13163. M. J. L. Marie, London. *Improvements in sugar turbines.* 21st August, 1890.

13343. J. J. Marshall, London. *Improved method of and apparatus for weighing granulating sugar and other suitable substances or materials.* 25th August, 1890.

13444. J. Y. Johnson, London. (Communicated by A. L. L. Peck, United States.) *Improvements in the manufacture of lactose or milk sugar.* 26th August, 1890.

14059. H. E. Hansen, London. *Improvements in apparatus for the complete evaporation of solutions.* (Complete Specification.) September 6th, 1890.

14104. H. C. Shaw, Liverpool. *Improvements in or relating to furnaces or apparatus for heating boilers, evaporating pans, and other structures.* 8th September, 1890.

ABRIDGMENTS.

12871. C. Roeckner, of 8, Tynemouth Place, Tynemouth; F. L. Roeckner and R. L. Roeckner, of Frogmore Mill, Hemel Hampstead, Herts, paper makers. *Improvements in and apparatus for concentrating and evaporating liquids and for burning off organic matter therefrom.* August 15th, 1889. This invention is divided into four heads. The first improvement consists in providing evaporating pans with a mid-feather rather shorter than the pan, and with paddles or agitators for keeping up a circulation. The second improvement relates to mechanical incinerators; the third and fourth are improvements in multiple-effect evaporators, and consist in placing the pipes or division plates, or even the vessels themselves, in a diagonal position.

19222. E. Theisen, of Sinzig-on-the-Rhine, Germany, engineer. *Improvements in apparatus for evaporating liquids.* November 29th, 1889. This invention relates to an improved construction of apparatus for evaporating liquids, consisting mainly of a centrifugal apparatus with rapidly revolving discs or plates, which are mostly of a dished form, into the central part of which the liquid to be evaporated and the air are introduced separately in order to be brought into intimate contact, either while passing along the plates or after issuing from the same. It is stated that in consequence of the rapid motion of the air, or of both the air and liquid, and also because of the effective distribution of both, a very rapid and energetic evaporation is effected, which ensures a very powerful action of the apparatus while occupying comparatively little space. Several modified forms of apparatus are shown in the drawings.

AMERICAN.

ABRIDGMENTS.

434441. Thomas Gaunt, of Brooklyn, New York. *Evaporating apparatus.* August 19th, 1890. This invention has for its objects to simplify and cheapen the construction of evaporators, such as shown in Patent No. 409,572. A series of pipes (preferably horizontal) pass through a closed casing and slightly project therefrom at each end. Heads or covers are applied to the ends of the said pipes, and are arranged in series so that steam may be caused to circulate through them. The liquor is fed into the top of the outer casing and flows over the outer surfaces of the pipes therein being thus evaporated "in transit." All parts of the apparatus are readily accessible for inspection, cleaning or repairs.

434074. L. Sternberg, of New York, assignor to F. O. Matthiessen & Wiechers Co., of Jersey City, New Jersey. *Process of sugar refining.* August 12th, 1890. The object of this invention is to get rid of the glucose contained in the raw solution, as a preliminary step to the extraction of the cane sugar. Quick lime is added to a 20% saccharine solution and the mixture boiled for about two hours. It is then run through a filter press to remove the precipitates, saturated with carbonic acid, and finally filtered.

433528. J. W. Lloyd, of Cincinnati, Ohio. *Device for evaporating liquids.* August 5th, 1890. This apparatus comprises an upper evaporating chamber and a lower steam chamber separated by a thin metal division plate. The steam chamber is strengthened by means of I iron stays riveted top and bottom, which may be perforated to allow proper circulation. The division plate is extended at one end, which extended portion is curved upwards to form a feed trough, a suitable gate being arranged between it and the chamber. It is stated that by the use of this device, steam of higher pressure than usual may be employed, and that less care is required to prevent burning, &c.

GERMAN.

ABRIDGMENTS.

50442. C. Bartels Söhne, Oschersleben. *Apparatus for producing pure sulphurous acid and means for impregnating liquids, especially saccharine juices with the same.* 13th June, 1889. The apparatus is in the form of an upright furnace with openings capable of being regulated for admitting air. Its several parts consist of

separating partitions, refrigerator, collecting chamber, and spiral pump. The sulphurous acid is produced by burning sulphur, which is placed in a suitable vessel, whilst the admittance of the air necessary for accomplishing the combustion is restricted or regulated. By directing the draught of air between the partition walls the sublimated sulphur which has undergone the combustion process is precipitated. The acid evolved is cooled in the refrigerator, drawn through the conical worm out of the furnace, and removed to the saturation vessels.

50443. E. Maigrot and J. Sabates, Havanna, Cuba. *Apparatus for clarifying saccharine juices by the aid of electricity.* 18th June, 1889. The apparatus consists of a large number of flat narrow troughs. These troughs are each divided by two porous membranes into three longitudinal divisions, the outer ones being filled with water and the inner ones with saccharine juice. In each division there is a row of carbon electrodes, the ones in the outer divisions being connected with the negative pole, and the ones in the inner division with the positive pole of a dynamo machine. The troughs are so connected the one with the other that the middle as well as the outer divisions together form a closed coil shaped channel. The sugar juice to be purified from the salts by electrical decomposition flows through the middle divisions of the troughs. The outer or side divisions contain water, which absorbs the acids arising from the electrolysation of the salts with alkalies.

50603. W. Greiner, Brunswick. *Heating arrangement for vacuum boiling apparatus.* 4th April, 1889. Concentric layers of pipes are arranged in the boiling apparatus, which are at one end each attached to a common inlet for steam, and at the other end to a waste pipe for the discharge of the condensed water.

50752. Carl Steffen, Vienna. *Apparatus for casing sugar.* 22nd September, 1888. (Addition to Patent No. 46958. 17th July, 1888.) The top and bottom open boxes, out of which the column shaped casing apparatus mentioned in the principal patent is formed, are replaced by boxes provided with perforated bottoms, preferably made of corrugated metal. At the top of the column arrangements are provided for compressing the air after the casing process is finished.

50831. E. W. Hopkins, London. *Improved process for extracting the sugar from molasses by the aid of barium-hydroxides.* 28th March, 1889. Sufficient hydrated sulphide of barium is added to the barium-

hydroxides which is used for precipitating the sugar from the molasses, to change the potash or soda salts of the molasses into alkaline sulphide. The solution or non-saccharine lye filtered off from the barium saccharate is saturated with carbonic acid in order to purify the alkaline sulphide from all trace of barium combinations. The alkaline sulphide then undergoes the process of fractional crystallisation which leaves it in a solid form.

51409. Maschinenbau-Actiengesellschaft vormals Breitfeld, Danek & Co., Prag-Karolinenthal. *Improvements in pocket filters with corrugated metal insertion plates.* 2nd April, 1889. (Addition to Patent No. 42,353, 15th March, 1887.) In the filter insertion plates mentioned in the principal patent, which are suspended in the vessel used for filtering the liquid; the thumbscrews or bolts for holding the plates are replaced by plates provided with spiral springs or obligue grooves, against which the insertion plates with wedge-shaped surfaces are pressed. This arrangement allows of these filter plates being changed more rapidly than the ones mentioned in the principal patent.

51514. Gustav Pröber, Dermbach i. Th. *Continuous acting centrifugal for sugar masse cuite and the like.* 31st March, 1889. Chambers arranged round the periphery of this drum serve for the automatic discharge of its contents. Its sides are provided with oblique or curved sieving surfaces, which offer a larger centrifugalling surface, and convey the sugar during the process of discharge towards the discharge openings which are placed between them. These sides are also surrounded by a second casing, or by plugs or closing pieces of an angular, circular, or segmental form, for the purpose of closing the discharge openings while the centrifugalling off of the syrup is in process. The opening of these latter, for the purpose of discharging the crystallised sugar, is accomplished by raising the drum by means of a movable wheel, the screw-threaded axis of which encircles the collar bed of the centrifugal. Suitable apparatus, placed beneath the drum, is provided for placing the closing pieces in movable connection with one another. The drum is surrounded with a jacket for receiving the syrup, which can be moved in a perpendicular direction, by means of a winding apparatus, and is guided by side rods. A movable discharge pipe is fixed to the bottom of the jacket. An outer fixed jacket also surrounds the drum for receiving the sugar. When the sugar is ready for discharging, the jacket for receiving the

syrup is lowered so far that the sugar is centrifugalled over the upper edge away into the outer jacket. The discharge is accomplished without the centrifugal being put out of action, and the work in this respect may be said to be continuous.

51820. O. Pillhardt, Grosz-Gerau, Hessen. *A pulp and cuttings receiver.* 31st March, 1889. The juice, which is to be purified from all particles and pulp, enters a pipe fixed in the apparatus, which sets a reaction wheel in motion and thus causes a cylinder to rotate. The juice on running through into the inside of the cylinder deposits its impurities on the cylindrical sieving surfaces, which impurities are conducted by scrapers into a conical receptacle connected with the apparatus. A discharge pipe is provided at the bottom of the apparatus for the purified syrup.

51965. Wilhelm Majert, Berlin. *A continuous acting diffuser.* 6th August, 1889. This diffuser for lixiviating beetroot shreddings consists of two cylinders, one being wider than the other; they are connected by an elbow-shaped pipe, in which a conveyor worm rotates. The beetroot shreddings pass through the narrow cylinder into the wider one. Water, moving in an opposite direction to the shreddings, is used to deprive them of all saccharine matter.

52067. Robert Pzillas, Brieg, Breslau. *Improved apparatus for drying sugar, either in the form of blocks or strips.* 26th September, 1889. The boards carrying the sugar strips are brought upon a waggon sideways into the drying chamber and shoved gradually forwards to the other end of the apparatus. Here they are removed from the apparatus by means of a waggon, which is drawn out sideways. The air used in the process of drying is warmed in a suitable apparatus and drawn by an exhaustor through the drying chamber. Any particles of sugar which have become detached from the strips are deposited in a room which is provided for the purpose with partitions.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

January 1st to August 31st.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Germany	3,618,827	4,609,610	3,063,403	2,763,454
Holland	339,227	345,352	284,700	199,382
Belgium	479,333	616,535	334,650	340,838
France	124,076	898,655	110,000	557,471
British West Indies & Guiana	1,457,841	1,060,398	1,388,798	802,893
British East Indies	1,419,344	460,999	969,572	237,045
China and Hong Kong	23,856	....	20,455	....
Mauritius	203,687	123,222	213,291	77,998
Spanish West India Islands	46,400	38,000	41,890	28,500
Brazil	696,792	281,316	498,436	170,797
Java	985,295	871,658	966,152	619,339
Philippine Islands	505,701	189,333	326,778	100,718
Peru	397,993	431,490	344,893	289,185
Other Countries	580,349	215,396	515,981	154,356
Total of Raw Sugars	10,878,721	10,141,964	9,078,999	6,341,976
Molasses	312,998	486,544	114,831	156,070
Total Sugar and Molasses	....	....	15,050,555	12,013,523
Refined Sugars.				
Germany	2,837,211	3,459,699	2,959,167	2,794,200
Holland	855,059	1,258,766	895,543	1,046,596
Belgium	163,758	98,354	176,136	88,805
France	1,100,216	1,786,483	1,198,765	1,451,285
United States	9,667	159,159	9,242	133,463
Other Countries	614,921	1,341	617,872	1,128
Total of Refined	5,580,832	6,763,802	5,856,725	5,515,477

EXPORTS.—Refined Sugars.

	Cwts.	Cwts.	£	£
Sweden and Norway	44,949	39,989	40,206	29,319
Denmark	73,368	96,816	61,482	59,358
Holland	57,679	61,180	49,377	43,339
Belgium	16,847	18,601	12,640	12,765
France	5,240	4,695	4,152	3,058
Portugal, Azores, & Madeira	39,416	57,511	33,912	38,319
Italy	53,655	59,810	47,890	40,477
Other Countries	85,476	154,001	79,415	116,916
Total of Exports	376,630	492,003	329,074	343,551

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of August, 1890, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1887, 1888, and 1889, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				Aug.	Aug.	Aug.	Monthly Average.				Aug.	Aug.	Aug.	Monthly Average.				Aug.	Aug.	Aug.
	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France.............	1363	1686	1888	3261	1362	1199	2418	5099	4855	3398	7904	1401	3619	7525	6462	6541	5286	11165	2763	4818	9943
Holland	3780	3267	3005	3211	4326	906	2843	2483	2675	3074	4656	2399	2502	5300	6263	5942	6079	7867	6725	3408	8143
Germany & Austria ..	1347	1510	2964	2762	1329	1118	2439	10463	11729	17245	18862	7962	6625	16780	11810	13239	20209	21624	9291	7743	19219
Belgium	592	622	995	369	674	411	257	308	227	267	245	143	55	230	900	849	1262	614	817	466	487
United States	454	8	..	71	..	..	285	2804	157	98	924	20	32	4311	3258	165	98	995	20	32	4596
Russia.............	3	..	..	..	..	..	..	452	1959	4275	..	3688	543	..	455	1959	4275	..	3688	543	..
Other Countries	..	1	14	..	..	5	..	15	2	10	8	..	537	4	15	3	24	8	..	542	4
Total	7539	7094	8866	9674	7691	3639	8242	21624	21604	28367	32599	15613	13913	34150	29163	28698	37233	42273	23304	17552	42392

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

To September 20th, 1890 and 1889. In Thousands of Tons, to the nearest Thousand.

	Stocks. 1890.	Stocks. 1889.	Deliveries. 1890.	Deliveries. 1889.	Imports. 1890.	Imports. 1889.
London	26	46	202	224	179	240
Liverpool ..	53	76	200	219	168	201
Clyde......	16	23	159	168	146	170
Bristol	1	1	50	40	49	36
Total ..	96	146	611	651	542	647

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Circular.)

For the four principal Ports. In Thousands of Tons, to the nearest Thousand. For August, 1890 and 1889.

	Stocks. August 1st. 1890.	Stocks. August 1st. 1889.	Deliveries. In July. 1890.	Deliveries. In July. 1889.	Imports. In July. 1890.	Imports. In July. 1889.
New York	28	42	58	67	49	68
Boston	5	4	13	3	12	3
Philadelphia....	4	..	30	16	28	12
Baltimore	..	..	..	..	..	..
Total......	37	46	101	86	89	83
	Decrease..	9	Increase ..	15	Decrease ..	6
Total for the year..........			876 —	779	902 —	794

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, September 11th, 1890.

Fair Refining.	96o/o Centfs.	Granulated.	Stand. A.	Stock in Four Ports.
Sept. 11, 1890.—5 7-16c.	6 1-16c.	$6\frac{5}{8}$c.	$6\frac{3}{8}$c.	Jan. 1, 1890— 11,169 tons.
Sept. 12, 1889.—$5\frac{5}{8}$c.	$6\frac{1}{4}$c.	$8\frac{1}{4}$c.	8c.	Jan. 1, 1889— 32,254 tons.
Sept. 13, 1888.—$5\frac{1}{2}$c.	$6\frac{3}{8}$c.	$7\frac{7}{8}$c.	$7\frac{1}{2}$-c.	Jan. 1, 1888— 47,798 tons.
Sept. 15, 1887.—$4\frac{7}{8}$c.	$5\frac{1}{2}$c.	6 5-16c.	$5\frac{7}{8}$c.	Jan. 1, 1887—102,279 tons.
Sept. 16, 1886.—$4\frac{3}{8}$c.	$5\frac{1}{4}$c.	6-6 1-16c.	$5\frac{5}{8}$ 11-16c.	Jan. 1, 1886— 57,328 tons.
Sept. 17, 1885.—5 7-16c.	6 3-16c.	7c.	$6\frac{5}{8}$c.	Jan. 1, 1885— 89,186 tons.
Sept. 11, 1884.—5c.	5 11-16c.	6 11-16c.	6 3-16c.	Jan. 1, 1884— 60,900 tons.
Sept. 13, 1883.—6 9-16c.	7 9-16c.	8 11-16c.	$8\frac{1}{4}$c.	Jan. 1, 1883— 50,297 tons.
Sept. 14, 1882.—$7\frac{1}{4}$c.	8c.	$9\frac{1}{8}$ 3-16c.	$8\frac{1}{4}$c.	Jan. 1, 1882— 43,927 tons.
Sept. 15, 1881.—$7\frac{7}{8}$c.	$8\frac{5}{8}$c.	10-$10\frac{1}{8}$c.	$9\frac{1}{4}$c.	Jan. 1, 1881— 66,999 tons.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 31ST AUGUST, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal *entrepôts*.	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
136	22	74	24	2	12	270	431	413

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST AUGUST, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal *entrepôts*.	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
1359	509	506	298	49	375	3096	2755	2720

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.	1886-87. Tons.
German Empire	1,265,000	990,604	959,166	1,012,968
France	787,989	466,767	392,824	485,739
Austria-Hungary	753,078	523,242	428,616	523,059
Russia	470,000	526,387	441,342	487,460
Belgium	215,000	145,804	140,742	135,755
Holland	55,813	46,040	39,280	36,098
Other Countries	80,000	87,000	79,980	69,127
Total	3,626,880	2,785,844	2,481,950	2,750,206

Based on the more accurate statistical figures now available for some countries, Mr. Licht has altered the figures originally given in April, and maintained up to now, as follows: Germany, 50,000 tons more; France, about 47,000 tons less; Austria-Hungary, about 38,000 tons more; Belgium, 5,000 tons less; about 4,000 tons less; making a total difference of about 3,000 tons less, which is tolerably near.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

Since our last report business in the cane sugar market has been, on the whole, limited, and in view of the continued scarcity of most kinds for immediate delivery, a further advance has taken place. The greatest rise has been in Cane Jaggery, Manila, Bahia, and Pernams, which are again in some cases 6d. dearer. Other sorts only about 3d. Beet sugar, under the influence of unfavourable reports respecting the coming crop, showed a decided tendency to advance, but the higher prices which were obtained during the first ten days of the month have given way under the influence of continued fine weather on the Continent, and the month closes with only a slight advance on the quotations ruling at the end of August. The increase in consumption, and the comparatively small stocks, would have had a greater effect on prices but for the extreme caution and reserve exercised by buyers. The stocks in grocers' hands are believed to be exceedingly small, and as no quantity of new sugar can be expected for at least two or three weeks speculators may possibly manage to seize the opportunity which unfavourable reports of the new beets would give them. The present state of things shows more convincingly than ever how everything turns on the beet crop. The American Tariff Bill, so far as regards sugar, is as yet unsettled, and even the date at which the eventual alterations are to come in force cannot be regarded as fixed. This factor has certainly had its influence on the market.

The prices obtained for refined are so unremunerative, considering the cost of raw sugars, that several refineries have stopped working. Prices of foreign refined close about the same as last month. The consumption in Europe for the twelve months ending 31st August is calculated at about 3,100,000 tons, against 2,775,000, 2,721,000, and 2,686,000 tons, for the three preceding years respectively. This shows that the invisible stocks which had been run down during the high prices of 1889 have again been filled up.

Present quotations for the standard qualities, as under, are:—

Floating.			Last Month.
Porto Rico, fair to good Refining	13/3 to 14/6	against	13/- to 14/3.
Cuba Centrifugals, 97°/。 polarization	15/3	,,	15/3
Cuba, fair to good Refining	13/6 to 14/-	,,	13/3 to 13/9.
Java, No. 14 to 15 D.S...	15/6 to 15/9	,,	15/6 to 15/9.
British West India, fair brown..	12/9	,,	12/6
Bahia, low to middling brown	11/6 to 12/3	,,	11/- to 11/9.
,, Nos. 8 to 9	12/3 to 13/9	,,	12/6 to 13/-.
Pernams, regular to superior Americanos.	12/- to 13/9	,,	11/6 to 13/6.

Landed.			Last Month.
Madras Cane Jaggery..	10/9	against	10/3
Manila Cebu and Ilo Ilo	10/3	,,	9/9 to 10/-.

Paris Loaves, f.o.b...	17/3	against	17/- to 17/3.
Russian Crystals, No. 3, c.i.f.	16/-	,,	15/9 to 16/-.
Titlers	18/3	,,	18/9
Tate's Cubes..	19/-	,,	20/-
Beetroot, German and Austrian, 88%, f.o.b.	13/3 to 13/6	,,	13/6 to 13/-

THE SUGAR CANE.

No. 256. NOVEMBER 1, 1890. Vol. XXII.

☞ The writers alone are responsible for their statements.

CHANGE OF ADDRESS.

All communications to be addressed to "The Editor of the Sugar Cane, Manchester."

For Table of Contents, see page i.

On page 578 will be found the text of the New Tariff passed by the United States Congress and approved by the President on the 7th October. On this subject Messrs. Willett and Gray make the following remarks, and we would call special attention to the statement that the increase of consumption is expected to be large, an opinion which is generally shared on this side of the water, and indeed is in accordance with all that experience has taught us:—

"Tariff.—We give the sugar schedule of the Tariff Bill in this 'Statistical' exactly as it has passed both Houses of Congress, and become a law to go into operation on and after April 1st, 1891. Until that time the sugar business will continue to be done as at present, and the important features connected with the date are that the benefits of free sugar to the people are delayed for six months, and the United States Treasury will continue to absorb the money from duties on sugar for the same length of time. Also that the entire Louisiana crop will be forced to market during five or six months, instead of nine months as customary. As this year's crop is larger than the last crop, say possibly 160,000 tons crop, against 128,344 tons last crop, it will necessitate marketing at the average rate of 7,000 barrels per day, an amount which cannot help having an adverse influence on the refined sugar markets for six months, and indirectly to some extent on the raw sugar market for say four or five months—to near March 1st—after which time refining can be carried on in bond, and the product be delivered free of duty after April 1st. On the 1st day of April, the Louisiana crop will have disappeared, and an immense vacuum will exist throughout the country in the supplies of refined sugar, which will absorb the bonded refining of March, and the daily output of April.

"On and after April 1st, 1891, sugars from all the world can come into the United States free of duty, if not above No. 16 Dutch Standard in colour. Heretofore sugars above No. 13 Dutch Standard have been virtually prohibited, and the admitting of Nos. 14, 15, 16 Dutch Standard on the same basis as No. 13 Dutch Standard will influence, and change to an important extent, the sugar business of the world. The Java sugar crop, which reaches 360,000 tons, and consists almost entirely of sugars above No. 13 Dutch Standard in colour, have heretofore gone mainly to the United Kingdom, but can now enter the competition for the American market. The bulk of the beet sugar crops of Europe are above No. 13 Dutch Standard, and an extra price has frequently been paid in order to obtain cargoes of not above No. 13 Dutch Standard for the United States, but now the entire beet crops can compete for the American market. Demerara and other countries are also given larger opportunities. This widening of the sources of supplies should cheapen the cost of raw sugar, and keep it closely to the point of lowest cost of production in either cane or beet sugar countries. Whatever demand there may be in the United States for sugar not above No. 16 Dutch Standard in colour for direct consumption must be supplied by cane sugar countries, as such beet root sugar is objectionable on account of flavour and odour. This demand will probably be limited nearly to the preserving of fruits, and manufacture of jams, &c., which business should receive an impetus from free sugar. For table use, refiners will no doubt continue to hold the trade.

"The duty of $\frac{1}{2}$c. per lb. on sugars above No. 16 Dutch Standard is sufficient protection against foreign refined of non-bounty countries. The duty of 6-10c. per lb. is equal to $\frac{3}{8}$c. per lb. protection against refined of bounty countries, and is sufficient protection probably unless the bounties are raised.

"The influence of the new tariff on the export of refined sugars is uncertain, and remains to be tested.

"The boiling of foreign molasses into sugar, which has been carried on in the United States to the extent of 50,000 to 60,000 tons per annum, will be abandoned, leaving the same amount to be supplied from other sources.

"The average increase of consumption of sugar in the United States for the past nine years is 5·08 per cent. per annum. The increased consumption resulting from free sugar should be large. It might easily reach several hundred thousand tons increase. This means increased business for refiners, at lower cost of refining, and on smaller capital required, than with duties to be paid.

"The duty on sugars above No. 16 Dutch Standard protects consumers against larger profits than $\frac{3}{8}$c. to $\frac{1}{2}$c. per lb. to refiners, while $\frac{3}{8}$c. per lb. profit will assure liberal dividends to their stockholders."

The opinion on the Continent seems to be that the new tariff will open a large market for beet sugars in the United States. The value of the imports of Austrian sugar alone, from July, 1889, to June, 1890 (12 months), was $2,050,483, or over £410,000.

The leading Cuban planters have agreed to petition the Spanish Minister for the Colonies in favour of arranging a scheme of reciprocity with the United States.

As far as can be seen, unless some difficulty should arise in connection with the reciprocity clause, the West Indian Colonies should profit very considerably by the new tariff. It is to be hoped no such obstacle may be raised by the Home Government as was caused by the action of Lord Derby on the last occasion when the West Indies attempted to negotiate a favourable arrangement with the States.

Baron H. de Worms, M.P., replying to a correspondent who drew his attention to some criticism on the operation of the M'Kinley tariff on British sugar exported to the United States says:—"I have always recognised the distinction to be drawn between bounties given by America on the production of sugar for native consumption, and those of the continental countries which grant export bounties, though both seem to me to be opposed to true Free Trade laws."

Sugar Trust Certificates declined several points during the first fortnight of October, in consequence of the uncertainties connected with the re-organisation.

The following is from the *Havana Weekly Report*:—

The weather has been generally so propitious to the growing cane, that in consequence of the reports received from the principal producing districts, the improvements introduced in the machinery of a large number of estates and the greater extension given this year to the culture of cane, impart strong hopes regarding the next crop to be the largest one taken off in Cuba during the decade.

In order to show to what extent the value of property and specially that of Real Estate has decayed in Cuba, we can mention a sugar plantation, situated at Vieja Bermeja, one of the best sugar districts on the Island, with 46 caballerias (about 1,520 acres) of good land, and all the machinery and buildings necessary to manufacture sugar, all in tolerable good condition, and which has just been sold for $16,000.

The land and installation of said estate cost, some years ago, over $250,000 and was recently valued in $108,500.

The reason of this heavy downfall in the value of property must be accounted for by the scarceness of money and the difficulty to obtain it in as large quantities as needed to run a sugar plantation even upon first class securities, and valuable property is often sacrificed, as only those who are able to dispose of large capital can to-day, with probabilities of good success, undertake the sugar manufacturing business.

The *Penang Gazette* states that the Penang Sugar Estates Co. have recently got out a lot of machinery of the newest type for the manufacture of sugar. They have also fitted up their sugar factory at Caledonia with electric light, which on being used for the first time proved a great success. There are eighteen arc lamps of one thousand candle power each, which are worked by two Victoria dynamos supplied by the Brush Co., of London.

According to a letter from Fiji, the Colonial Sugar Company are talking of putting up a mill in Vanua Levu on the Labasa. They have been taking levels of and surveying the land. Most probably they will first try 100 acres of cane, and if it grows and turns out well then launch out further.

On page 598 will be found an extract from an address presented to the Governor of Barbados by the Agricultural Society, which is so convinced of the good resulting from the experiments at Dodds, that it urges the establishment of a second station in a different part of the island, where the soil and climatic conditions are different, especial regard being had to manures.

In connection with manures, we regret to be unable to find space this month for extracts from a valuable report of the Colonial Company, Limited, on the results obtained on their estates in British Guiana.

Want of space also compels the omission of a notice of Professor Wiley's valuable report on the culture of the sugar beet and the manufacture of beet sugar, and of our usual report on the results of the working of German sugar factories. We may just remark that the Aktien-Zuckerfabrik Holland at Köthen (capital 630,000 marks) has declared a dividend of 64¼ per cent., and possesses a reserve fund of 420,000 marks.

Reports of a probable change in the German sugar legislation are again being circulated. We still maintain our opinion that nothing will be done for the present.

Following on our remarks of last month respecting the cost of production of sugar in German factories, we now give four tables, carefully selected so as to give as fair an idea as possible of the real facts. The law does not exactly prescribe the details to be given, consequently the reports vary in form somewhat, and we have had to pass by several, owing to want of clearness. We think these tables will show that in some factories at least sugar can, as we stated, be produced at 9s. per cwt., and from information received we incline to believe that the number of factories which can do this will be considerably increased in 1891. We hope to supply further information on this point before long.

TABLES SHOWING COST OF PRODUCTION OF ONE TON OF BEET SUGAR IN GERMANY, 1889–90.

I.

Extract from the Report of the Weetzen Sugar Factory (erected 1883). Taken from the German Official Gazette (*Deutsche Reichs-Anzeiger*).

Share Capital—750,000 marks.

Quantity of beets worked up—32,751 metric tons (2,204·62 lb. English).

General expenses, including amortization..	246,497·12 marks.
Beets (cost of production, 16 marks per ton)	524,016·00 ,,
Together	770,513·12 marks.

Manufacturing expenses per ton of beets........	7·83 marks.
General expenses per ton of beet	23·83 ,,

According to the Imperial Statistical Office, in 1889–90 7·954 tons of beet yielded 1 ton of sugar.

$$23{\cdot}83 \times 7{\cdot}954 = 189{\cdot}54 \text{ marks per ton of sugar.}$$

Equivalent to 9s. 5d. per cwt., delivered at the railway station, not taking into account the molasses (3%), beet slices (60%), and lime scum (10%).

II.

Extract from the Report of the Malchin Sugar Factory (erected 1882).

Share capital—600,000 marks.

Quantity of beets worked up—50,468½ metric tons.

General expenses, including amortization..	473,641·15 marks.
Beets (16 marks per ton)	807,496·00 ,,
	1,281,137·15 marks.

Manufacturing expenses per ton of beets	9·38 marks.
General expenses per ton of beets...............	25·38 ,,

7·95 tons of beet were required to make 1 ton of sugar.

$7{\cdot}95 \times 25{\cdot}38 = 201{\cdot}77$ marks.

Equivalent to about 10s. 1d. per cwt., delivered at the railway station, not including credits for molasses, scum, slices, &c.

III.

Extract from the Report of the Uffingen Sugar Factory (erected 1849). Taken from the German Official Gazette.

Capital—274,500 marks.

Quantity of beets worked up—20,008 metric tons.

General expenses, including amortization ..	177,706·27 marks.
Beets (16 marks per ton)..................	320,128·00 ,,
	497,834·27 marks.

Manufacturing expenses per ton of beet	8·89 marks.
General expenses per ton of beet	24·89 ,,

7·95 tons of beet were required to produce 1 ton of sugar.

$7{\cdot}95 \times 24{\cdot}89 = 197{\cdot}88$ marks.

Equivalent to about 9s. 11d. per cwt., delivered at the railway station, not taking into account credits for molasses, scum, slices, &c.

IV.

Extract from the Report of the Mattierzoll Sugar Factory (erected 1870). Taken from the German Official Gazette.

Share capital—342,000 marks.

Quantity of beets worked up—32,107½ mêtric tons.

General Expenses, inclusive of amortization	284,621·46 marks.
Beets (16 marks per ton)..................	413,720·00 ,,
	698,341·46 marks.

Manufacturing expenses per ton of beets	5·75 marks.
General expenses per ton of beets	21·75 ,,

7·95 tons of beets were required to produce 1 ton of sugar.

$7{\cdot}95 \times 21{\cdot}75 = 172{\cdot}91$ marks.

Equivalent to about 8s. 7d. per cwt., delivered at the railway station, not taking into account credits for molasses, scum, slices, &c.

THE ARTIFICIAL PRODUCTION OF SUGARS.

By Sir Henry E. Roscoe.

Barely have sixty-two years elapsed since the great German chemist Wöhler prepared urea artificially. Up to that date the opinion was generally held that all chemical compounds which are found in the bodies of animals or plants could not be made artificially. They, it was said, are the results of vital action, and the endeavour to prepare them in the laboratory was considered as impossible, and almost as wicked as to try to manufacture an homunculus. Wöhler's discovery at once dissipated that false notion, and since his time the labours of chemists have resulted in the manufacture of hundreds of compounds formerly only obtainable by natural processes carried on in living organisms. The latest and perhaps the most remarkable of these triumphs of synthetic chemistry has just been made known to us. The group of bodies termed by chemists the carbo-hydrates—because they are composed of carbon united with oxygen and hydrogen in the proportion in which those two elements combine to form water—contain the well-known series of sugars, gums, and starches. The chemical composition of these bodies has long been known, but a knowledge of their constitution—that is, the mode in which their several constituent parts are put together—has only recently been acquired. It is clear that until we know what is the structure of a complicated arrangement of atoms, it is useless to attempt to build up that arrangement. We must have a plan of the house before we can build it. Such a plan of the structure of the sugars is now in our possession, and their artificial production has therefore become a possibility, and in the hands of a distinguished German chemist, Professor Emil Fischer, of Würzburg, that possibility has just been converted into a reality. The various steps by which this great result has been accomplished can only be explained and appreciated by those familiar with the intricacies of modern organic chemistry. But the importance of the discovery is patent to all. The group of carbo-hydrates (sugar and starch), are, next to the albuminoids (eggs and flesh), the most important material needed to support animal life. Indeed, the vegetarians would, and perhaps rightly, place them first. Can we look forward to a time when the chemist will manufacture our sugar, when the sugar cane and the beet root will cease to be planted, because their products can be more cheaply manufactured from coal or wood? Results apparently

as improbable have happened. Who could have foreseen that the thousands of acres upon which the madder-plant grew in France and Turkey would now yield corn and hay, because it was found that the dye formerly obtained from that plant can be more cheaply made from coal-tar? So, too, indigo has been artificially obtained, and who can tell that a recent new process for its manufacture may not prove fatal to the indigo planter? That the process of making sugar artificially is now too expensive to compete with Nature is, therefore, no proof that cheaper processes will not be discovered; indeed, that this will happen may be taken for granted. So that, looking back to the enormous strides which chemistry has made during the last half-century, and seeing what has already been accomplished, he would be a bold man who should dare to define the limits of her power, or to declare that our grandchildren may not use artificial sugar to sweeten their tea, and that Jamaica may know the sugar cane no more. From a biological point of view, too, this discovery is of deep interest and importance. We know nothing, or as good as nothing, of the processes by which sugar is produced in the plant, nor how this sugar is transformed into starch, fat, and woody fibre. Are these results due to a special vital force, or does this expression merely serve as a cloak for our ignorance, and will careful investigation show that these substances are built up in the plant by methods similar to those which are now successfully employed in our laboratories? That this latter is the true view is the belief of the chemist, and nearer towards that end the discovery of Fischer has undoubtedly brought us.

An interesting physiological question now presents itself. Supposing that these artificial sugars were to become articles of common diet, what will be their effect on the animal economy; That two chemical compounds may possess the same composition, and even the same chemical arrangement of their parts, and yet act differently from a physiological point of view, is well known. And still more likely will this be if the artificial sugar differs in composition from the natural one. The blood and tissue which are formed from the artificial carbo-hydrates may differ from those which are the results of the assimilation of the natural sugars. If the pig and the goose were fattened on an artificial diet, their fat might differ from that which they now form; and the bee fed on manufactured sugar might yield another kind of wax.

But we may go one step further. We know that plants not only convert sugar into fat, starch, and woody fibre, but that in presence of certain minute organisms they form nitrogenous or albuminoïd compounds such as the gluten of wheat. Supposing it were possible to feed plants or these minute organisms on artificial sugars, differing in their properties from their ordinary food, it might force the plant to manufacture a new kind of albumen. And then what new structures might not be expected to start up from the use of the new building material?

Chemistry would then, for the first time, bring her potent influence to bear upon the structure of organised beings, and the changes of form which would result might prove to be of the strangest and most unexpected kind—changes far more remarkable than all those, singular and far-reaching though they be, caused by processes of artificial selection or of cross-breeding. The revelations of science have already outstripped the marvellous. What yet remains concealed in her bosom defies the wit of man to foretell.

The Speaker.

DEMERARA CRYSTALS.

(Letter to the Editor of the *Analyst.*)

Sir,—During the last few months considerable attention has been attracted among public analysts to the largely increasing substitution by grocers of an imitation article for the well-known Demerara yellow crystals, and as considerable misconception appears to exist in analytical circles as to these, it has occurred to me that a few words on the subject from one who has been closely associated with the manufacture of the real product for some years may not come amiss to your readers.

The term "Demerara crystals" is applied to the yellow crystallised grocery sugar coming from the colony of British Guiana (of which Demerara forms a part). Recently a similar sugar has also been produced by some of the West India Islands, where the Demerara process of manufacture has been adopted.

The peculiarity of this sugar is that, although it may be said to be refined—containing, as it does, from 95 per cent. upwards of sucrose, according to the degrees of dryness required by market considerations, the characteristic smell and sweetness of the cane juice has

been to a large extent preserved. To secure this end, a process has to be adopted of a special nature, and a product is thus obtained which, on account of its possessing the attributes mentioned above, commands a relatively high price in the sugar market, where only sugar coming under the above definition is sold as such.

In order that the essential features of this specific sugar may be readily grasped, it may be as well to briefly describe the principal points in the manufacture, especially those in which the divergence from the general lines of sugar-making occurs.

As doubtless your readers are aware, cane juice consists chiefly of a solution of sucrose, with small and varying proportions of glucose, albuminous pectinoid and mineral matters, &c., and with a colouring matter, *yellow* when free and *green* when united with bases, with which it forms feeble combinations.

As the cane juice comes from the mill, it is treated with sulphurous anhydride, prepared by burning sulphur in a current of air, Distinct acidity is thus imparted to the juice, and the colour of this, which, as it came from the mill, was dirty yellow, is now changed to a delicate greenish-yellow. This change of colour is due to the decomposition of the green colouring compound mentioned above, by the organic acids set free by the sulphurous acid.

The juice is now raised to a temperature of from 212° F. to 225° F. in a closed vessel through which a constant stream of juice is passing, and on emerging is treated with milk of lime, to effect precipitation of the albuminous matter. The smallest quantity of lime that will give a juice sufficiently clarified for subsequent crystallisation is used, so that the colouring matter may be preserved as much as possible in its free—and yellow—state; but unavoidably, to a greater or less extent, according to the purity of the juice, the colour of the clear product drawn off from the subsided precipitate is of too green a colour to yield a high-class yellow sugar. Indeed, should, at this stage of the manufacture, sufficient lime be added to make the juice distinctly alkaline, although a bright clarification would be obtained, the colouring matter would be too much acted upon for any subsequent process to rectify.

In the old method of manufacture, where the concentration of the thin juice from the clarifiers to the state of syrup ready for the vacuum pan was carried out under atmospheric pressure on the costly and destructive "copper wall"; the acidity produced by the passing over this, with its high temperature and tumultuous treatment,

rectified to some extent this lime effect on the colouring matter, especially if the concentration were carried far during this process; but this end was only obtained by great loss in manufacture from immersion, &c.

In the present method, evaporation in vacuo takes the place of the "copper wall," and as, during this stage, if properly conducted, no chemical change of any moment takes place, the colouring effect of the lime has to be nullified before the juice is subjected to concentration. This is done by the addition of phosphoric acid to the clear liquor from the clarifiers, and subsequent brief ebullition in what are known as "eliminators." This agent is added in sufficient quantity to liberate enough of the organic acids to recall the yellow colour which the juice possessed prior to the addition of the lime, and, at the same time, a considerable quantity of the lime, whose organic salts are prejudicial in sugar-making, is got rid of. Care, however, must be taken, and this applies equally to the "sulphuring" in the first stage of manufacture, that enough is not added to give rise to free phosphoric acid in the liquor, which would lead to loss later on.

Concentration of the liquor, which has received the finishing cleansing touches during its stay in the "eliminators," is now carried on in vacuo in some sort of "multiple effect" until a density of from 25° to 35° Baumé is arrived at. A light, yellow-coloured syrup is thus obtained, which is immediately further concentrated and granulated in the vacuum pan.

When this operation is finished, a stiff magma of crystals and "mother liquor" or molasses, of a delicate greenish gold colour is obtained, and to further improve upon and fix, as it were, this colour, a solution of stanous chloride, in the proportion of about 1·3lbs. of the latter to a ton of sugar is added. This magma or "massecuite" is now subjected to a separating process in the centrifugals, and the light yellow crystals thus obtained, the greater portion of the tin passing away in the molasses.

It is thus seen, and I wish to particularly impress this upon your readers, that the colouring matter of Demerara crystals is emphatically the colouring matter of the cane juice, and that the great object of the manufacture is to retain this colouring matter, and at the same time to produce a sugar of high saccharine richness.

And it is in doing this that another distinctive feature of this class of sugar is yielded, viz., the characteristic smell of cane juice which it possesses. It is owing to these qualities—colour, smell, and rich-

ness—that Demerara sugar holds the position it does in the sugar-making world.

A high-class yellow Demerara sugar, therefore, necessitates the use of a minimum quantity of lime, and the maintenance of a high degree of acidity throughout the process. I leave it to those practically acquainted with the working of cane juice to realise the difficulties associated with satisfactory manipulation on these lines, especially with the immature juice frequently met with in Demerara. Suffice it to say that, by efficient machinery and by careful and thoughtful work, it is possible to obtain results as regards the quantity of sugar extracted from the juice as good as those derived from the easier paths of the manufacture of refining crystals.

As already stated, these crystals occupy a high position among sugars in the home markets, and the result of this has been the production, by several refiners here, of distinct and avowed imitations, which, although sold in the market as "refiners' yellow crystals," are eagerly bought up by the trade and handed over to the consumer as "Demerara yellow crystals."

To produce these imitations, all that the refiner has to do is to purchase refining beet sugar, recrystallise it if necessary, so as to produce the crystalline condition of the Demerara sugar, and colour it, as it is admitted that it *is* coloured, by a preparation of a yellow aniline product, which possesses an aromatic odour, and which thus masks, when fresh, the characteristic unpleasant smell of beet sugars.

There is thus obtained, instead of a cane sugar possessing the actual colouring matter and smell of cane juice, a product prepared of inferior material and artificially coloured so as to simulate the real article.

This fraudulent substitution of an imitation for a real article goes on to an enormous and increasing extent. *Cæteris paribus*, it is bought for less in the market and retailed as the higher priced and genuine product.

The present position thus is, that the West Indian proprietors, after investing enormous capital in the form of machinery and skilled labour, in order to produce a pure and attractive sugar, find themselves compelled to undergo competition in the very market in which it would be thought their rights would be recognised, with adversaries who are allowed to carry on a trade in an imitation and inferior article with impunity.

There is one point in connection with the manufacture of Demerara

sugar which may need comment, and that is, the use of a tin salt in the penultimate stage of the process. The use of this agent was commenced in 1881, but it was not until the following year generally adopted, on account of the uncertainty, from want of evidence, of the physiological position of small quantities of tin, the West India Committee having, in the meantime, investigated the question carefully, and satisfied themselves, by the evidence of Dr. Stevenson, Messrs. Hehner, Wigner, and others, that no fear need be entertained that a prejudicial influence on health would arise from the small quantities—from ·25 grains to ·33 grains to the lb.—of this metal found to be present in the sugars thus made. Dr. Stevenson, in experiments on dogs, carried out at the instance of the Committee, found that, with a diet almost entirely composed of the sugar in question, no interference whatever with health had resulted. Since then, some 500,000 tons have been consumed in the United Kingdom, without a single ill effect having been traced to its use.

I am, Sir, faithfully yours,

FREDERIC J. SCARD,

Chemist-in-chief to the Colonial Company, Limited.

SUGAR BEET CULTIVATION IN ENGLAND.

For some time lately, as the readers of *The Sugar Cane* will be aware, endeavours have again been made to bring the question of producing sugar in England to the front. They will also be aware that we have never yet been convinced of the feasibility of the undertaking. No one, however, who is acquainted with the complete revolution which farming has undergone during the past few years, and the impossibility of making farming profitable by growing corn and roots under the old systems and at anything like the rents formerly paid, can wonder that it should be thought worth while to make at least one more trial with sugar beet-growing. And so we find the editor of the *South West Suffolk Echo* making a praiseworthy attempt to call public attention to what is regarded by many men of great ability and experience as a still open question. The failure of the attempts to produce beet-sugar, which were made in 1868 and 1884, was due to some extent to special causes. We fear, however, that the pioneers in the attempt to make beet sugar production a commercial success must be content to work under great initial

discouragement, and must not expect any immediate return for their capital. On one point there cannot be two opinions, and that is that if our climate permits the regular growth on a manufacturing scale of beets having a satisfactory saccharine content, and if the price obtainable for beet-sugar will allow of a proper price being paid to the cultivator, a considerable number would find work who at present are not anything like fully employed, and a welcome substitute would be found for crops that are at present unremunerative. And if the experiment is again to be tried, we would say "Now or never," for there is a great probability that we are approaching a period, not very distant, when the value of land will be considerably and possibly permanently enhanced. It will then be no time to try costly experiments, whereas we now have land at an unprecedentedly low rent, and labour often vainly seeking employment. Having said so much by way of introduction, we have great pleasure in giving the following extracts from the article above alluded to. We have omitted the portion relating to bounties and the cost of carriage, as we do not feel at all sure that the correctness of the figures given is not open to considerable dispute. We fear also that but few farmers are now in a position "to associate themselves in the undertaking"—"as partners," though this method of working is rightly characterised by the writer as one of the main elements of success in Germany.

"But putting this consideration aside"—*i.e.*, that there may come a sudden change in the fiscal systems of France and Germany, which would abolish the bounties and leave a better opening for English beet sugar—"it should be possible to re-establish and carry on the industry profitably even in opposition to bounty-fed sugar. A large grower of sugar-beet, Mr. W. Biddell, of Lavenham, informs us that if 10 per cent. of sugar could be obtained from the home-grown beet the industry might, in his opinion, be profitable. And inasmuch as he grew beet largely for the Lavenham Sugar Works, and was no doubt familiar with the conditions and causes which operated against the industry when it was working, it is something that he sees a margin of profit even if the conditions be as they are now, provided that 10% of sugar be obtained from the beet. As to this, the results of experiments made by Dr. Voelcker, Chemist to the Royal Agricultural Society, should not be without interest and value at this time, and these show that Suffolk roots are richer in sugar than either French or German beet. The average percentage of sugar in French roots is 10½; in German roots the average is under 12, and of sugar

in roots from Suffolk there is 12 per cent., or two per cent. more than what, in Mr. Biddell's opinion, is required to make the sugar-beet industry profitable. This is an important point. We start with an advantage, and it is no small advantage, that roots grown in England are relatively richer than those of foreign countries.

"Obviously the English producer should not be beaten in his own market. Yet the fact remains that he is beaten, or rather that he is kept out of his own market, and that from eight to ten millions sterling are handed annually over to foreign producers. Nor is it very comforting to say that the foreign producers probably take the money all out in goods. This does not alter the fact that money or money's worth, to the extent of from eight to ten millions, goes from, instead of into, the pockets of our countrymen. Now, why, it may be asked, are we kept out of our own sugar market? We have endeavoured to show that the bounties are not so formidable as they appear to be. And the evidence of experts, if it be worth anything, goes to prove that the sugar-beet in England is richer than the foreign root.

"The previous attempts failed, not because the climate or the soil was unsuitable, but clearly enough because the co-operation of farmers had not been secured. Their co-operation is essential in order that there may be no failure in the supply of roots. On the Continent where beetroot is grown the farmers in each district club together and build a factory, each farmer undertaking to deliver to the factory a certain weight of beetroot. An adequate area of beetroot is cultivated for a period of years, and the crop each season keeps the factory going. There is no failure in the supply; indeed the owners, after completing their own contract, often buy roots in the open market for the factory, so that the minimum quantity may be secured. Provision of this kind appears to have been lost sight of, when seven years ago the sugar-beet factory was re-opened at Lavenham. And this probably was the main cause of the failure of that venture. There were other difficulties, but none that might not have been brushed away; and if at the outset the farmers had been associated more intimately with the undertaking—if they had been induced to ally themselves with it as partners—the probabilities are that it would have been successfully established. But let us regard the failure of that undertaking rather as a step in the direction of success, than as one the other way. And if it be that another effort is being made at Lavenham, let us suggest that before and

above everything the co-operation of the farmers be secured. Why not re-open the factory on the German plan? Make it a farmers' affair. There is no doubt that sugar-beet can be grown for 18s. or 20s. a ton. The introduction of nitrate of soda has promoted its cultivation wonderfully; indeed Mr. James Duncan, the originator of the Lavenham enterprise, refers to nitrate as the sheet-anchor of beet cultivation."

FRANCE.

Results of the 1889-90 Campaign.

According to the official statistics made up to the end of August, the quantity of beetroot worked up in this campaign by the 371 out of 373 factories in activity (against 380 in the preceding campaign) was about 6,665,800 tons, to which must be added the quantity, not accurately known, required for supplying two distilleries. The *Journal des Fabricants de Sucre* thinks the total quantity may be safely set down at 6,673,600 tons in round numbers. The quantity worked up into sugar was about 2,448,900 tons more than in the preceding campaign.

The yield in sugar obtained is calculated at 10·50 per cent., against 9·83 per cent. in the previous year, the figures being (as usual) reduced to refined equivalent. Owing, however, to the method of calculation adopted by the official statisticians, the above-named journal considers that the real yield is only 10·02 per cent., and that, consequently, the figures given for the *excédents* and for the premium obtained by the French sugar manufacturers are proportionally exaggerated. This extraordinary good result is, it must be remembered, to be attributed almost entirely to the remarkably favourable season, as the area under cultivation was not much greater than in the preceding campaign. The quantity exported amounted to about 267,000 tons.

The question of the amount of premium gained on this large production of sugar, which far exceeds anything hitherto obtained in France, is not without interest. By the *Deutsche Zuckerindustrie* it is calculated at 11·40 francs per 100 kilos. of refined, equal to 10·26 francs per 100 kilos. of raw sugar, or 4s. 1d. per cwt. We cannot wonder that the Government considered the time had come when this industry should cease to enjoy such an exceptional position at the expense of the Treasury.

GERMANY.

Results of the 1889-90 Campaign.

The official statistics of the last campaign in Germany show that the quantity of beets worked up is about 9,825,000 tons, against 7,896,000 tons in the previous campaign. The increase is to be attributed mainly to the exceptionally favourable season, as the area under cultivation was, as was the case in France, very little more than in the preceding year.

The yield was (in raw sugar) 12·57 per cent., against 11·96 and 13·08 per cent. respectively in the two preceding campaigns. One especially noteworthy point is the extraordinary increase in the export of refined sugar. A large part of this increase is due to the increased import of foreign refined into England. The export of refined was more than three times greater than in 1885-86, and was over 50,000 tons in excess of that of 1888-1889. The export of raw sugar was also over 80,000 tons more than in 1888-89. The amount of drawback allowed on exported sugar last campaign was 65,887,023 marks = about £3,294,000.

AUSTRIA.

Amount of Premiums on Export.

We are indebted to the *Journal des Fabricants de Sucre* for the following details of the rates of premiums and information respecting the conditions under which they are granted. Sugars polarising less than 93 and not less than 88 per cent., 1 fl. 50 per 100 kilos. Sugars polarising less than 99½ and at least 93 per cent., 1 fl. 60. Sugars polarising at least 99½ per cent., 2 fl. 30.

At the present rate of exchange, these premiums are equal to 3 fr. 30, 3 fr. 42, and 5 fr. ·06 per 100 kilos. of sugar. (This would equal 1s. 4d., 1s. 4½d., and 2s. 1d. per cwt.) But the total amount of the premiums is limited to fl. 5,000,000 in each campaign (equal to about £416,500), and in case this figure is exceeded, the difference has to be repaid to the Treasury by the manufacturers and refiners.

In 1888-90 the exports subject to premium were:—244,142 tons of refined, at 1 fl. 30 per 100 kilos.; 129,271 tons of raw, at 1 fl. 60 and 96,478 tons of raw at 1 fl. 50; the total amount of premium being fl. 7,828,295 (about £652,000). The manufacturers and refiners will therfore have to repay fl. 2,828,295 (£235,000), which reduces the rates of premium to 1 fl. 47, 1 fl. 02, and 0 fl. 95 per 100 kilos. respectively. (This equals 1s. 4d., 10½d., and 10d. per cwt. respectively.)

SUGAR CANE SEED.

The *Propagateur de la Martinique* remarks :—

We are very glad to learn that several of our planters have decided to make trials with cane seed. One of our large proprietors has made it a question of competition amongst his managers, the one who obtains the best results will receive a premium. This is a clever idea, and a practical example which we should be glad to see imitated.

The following is from the *Demerara Argosy* :—

As a matter of record it may be mentioned that the first ripe cane arrows of the season were gathered and sown on the 14th September, at the Botanic Gardens, though canes are very backward this year, and are consequently flowering very sparsely. The arrows above mentioned were gathered a fortnight earlier than the first ripe arrows were procurable last year. We have said they were sown on the 14th September. Four days later the seeds showed germination, and on the following day numbers could be seen on close scrutiny springing through the soil. Two arrows were sown in separate boxes, one fully ripe and breaking up, the other not quite so advanced as to be breaking up. The fully ripe one has produced many more plantlets than the less ripe one. Some of the first generation of seedling canes, raised in 1888 in Barbados, are arrowing freely at present, and a second generation will no doubt be raised from them this year. Others, however, of the same original batch give no promise yet of performing this function.

UNITED STATES.

THE NEW SUGAR TARIFF.

The following is the text of the new tariff as far as regards sugar :—

"Schedule E, Sugar.—That on and after July first, eighteen hundred and ninety-one, and until July first, nineteen hundred and five, there shall be paid, from any moneys in the Treasury not otherwise appropriated, under the provisions of section three thousand six hundred and eighty-nine of the Revised Statutes, to the producer of sugar testing not less than ninety degrees by the polariscope, from beets, sorghum, or sugar-cane grown within the United States, or from maple sap produced within the United States, a bounty of two cents per pound; and upon such sugar testing less

than ninety degrees by the polariscope, and not less that eighty degrees, a bounty of one and three-fourth cents per pound, under such rules and regulations as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe.

"The producer of said sugar to be entitled to said bounty shall have first filed prior to July first of each year with the Commissioner of Internal Revenue a notice of the place of production, with a general description of the machinery and methods to be employed by him, with an estimate of the amount of sugar proposed to be produced in the current or next ensuing year, including the number of maple trees to be tapped, and an application for a license to so produce, to be accompanied by a bond in a penalty, and with sureties to be approved by the Commissioner of Internal Revenue, conditioned that he will faithfully observe all rules and regulations that shall be prescribed for such manufacture and production of sugar.

"The Commissioner of Internal Revenue, upon receiving the application and bond hereinbefore provided for, shall issue to the applicant a license to produce sugar from sorghum, beets, or sugar cane grown within the United States, or from maple sap produced within the United States at the place and with the machinery and by the methods described in the application; but said license shall not extend beyond one year from date thereof.

"No bounty shall be paid to any person engaged in refining sugars which have been imported into the United States, or produced in the United States upon which the bounty herein provided for has already been paid or applied for, nor to any person unless he shall have first been licensed as herein provided, and only upon sugar produced by such person from sorghum, beets, or sugar cane grown within the United States, or from maple sap produced within the United States. The Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall from time to time make all needful rules and regulations for the manufacture of sugar from sorghum, beets, or sugar cane grown within the United States, or from maple sap produced within the United States, and shall under the direction of the Secretary of the Treasury, exercise supervision and inspection of the manufacture thereof.

"And for the payment of these bounties the Secretary of the Treasury is authorised to draw warrants on the Treasurer of the United States for such sums as shall be necessary, which sums shall be certified to him by the Commissioner of Internal Revenue, by whom the bounties shall be disbursed, and no bounty shall be allowed or paid to any person licensed as aforesaid in any one year upon any quantity of sugar less than five hundred pounds.

"That any person who shall knowingly refine or aid in the refining of sugar imported into the United States or upon which the bounty herein

provided for has already been paid or applied for, at the place described in the license issued by the Commissioner of Internal Revenue, and any person not entitled to the bounty herein provided for, who shall apply for or receive the same, shall be guilty of a misdemeanor, and, upon conviction thereof, shall pay a fine not exceeding five thousand dollars, or be imprisoned for a period not exceeding five years, or both, in the discretion of the Court.

"All sugars above number sixteen Dutch standard in colour shall pay a duty of five-tenths of one cent per pound: *Provided*, That all such sugars above number sixteen Dutch standard in colour shall pay one-tenth of one cent per pound in addition to the rate herein provided for, when exported from, or the product of any country when and so long as such country pays or shall hereafter pay, directly or indirectly, a bounty on the exportation of any such sugar which may be included in this grade which is greater than is paid on raw sugars of a lower saccharine strength; and the Secretary of the Treasury shall prescribe suitable rules and regulations to carry this provision into effect: *And further provided*, That all machinery purchased abroad and erected in a beet-sugar factory and used in the production of raw sugar in the United States from beets produced therein shall be admitted duty free until the first day of July, eighteen hundred and ninety-two: *Provided*, That any duty collected on any of the above-described machinery purchased abroad and imported into the United States for the uses above indicated since January first, eighteen hundred and ninety, shall be refunded.

"Sugar candy and all confectionery, including chocolate confectionery, made wholly or in part of sugar, valued at twelve cents or less per pound, and on sugars after being refined when tinctured, coloured, or in any way adulterated, five cents per pound.

"All other confectionery, including chocolate confectionery, not specially provided for in this Act, fifty per centum *ad valorem*.

"Glucose, or grape sugar, three-fourths of one cent per pound.

"On the Free List.—Sugars, all not above number sixteen Dutch standard in colour, all tank bottoms, all sugar drainings and sugar sweepings, syrups of cane juice, melada, concentrated melada, and concrete and concentrated molasses, and molasses.

"That the provisions of this Act providing terms for the admission of imported sugars and molasses and for the payment of a bounty on sugars of domestic production shall take effect on the first day of April, eighteen hundred and ninety-one: *Provided*, That on and after the first day of March, eighteen hundred and ninety-one, and prior to the first day of April, eighteen hundred and ninety-one, sugars not exceeding number sixteen Dutch standard in colour may be refined in bond without payment of duty,

and such refined sugars may be transported in bond and stored in bonded warehouse at such points of destination as are provided in existing laws relating to the immediate transportation of dutiable goods in bond, under such rules and regulations as shall be prescribed by the Secretary of the Treasury.

"Reciprocity.—Section 3.—That with a view to secure reciprocal trade with countries producing the following articles, and for this purpose, on and after the first day of January, eighteen hundred and ninety-two, whenever, and so often as the President shall be satisfied that the Government of any country producing and exporting sugars, molasses, coffee, tea, and hides, raw and uncured, or any of such articles, imposes duties or other exactions upon the agricultural or other products of the United States, which in view of the free introduction of such sugar, molasses, coffee, tea, and hides into the United States he may deem to be reciprocally unequal and unreasonable, he shall have the power and it shall be his duty to suspend, by proclamation to that effect, the provisions of this Act relating to the free introduction of such sugar, molasses, coffee, tea, and hides, the production of such country, for such time as he shall deem just, and in such case and during such suspension, duties shall be levied, collected, and paid upon sugar, molasses, coffee, tea, and hides, the product of or exported from such designated country as follows, namely:—

"All sugars not above number thirteen Dutch standard in colour shall pay duty on their polariscopic tests as follows, namely:—

"All sugars not above number thirteen Dutch standard in colour, all tank bottoms, syrups of cane juice or of beet juice, melada, concentrated melada, concrete and concentrated molasses, testing by the polariscope not above seventy-five degrees, seven-tenths of one cent per pound; and for every additional degree or fraction of a degree shown by the polariscopic test, two hundredths of one cent per pound additional.

"All sugars above number thirteen Dutch standard in colour shall be classified by the Dutch standard of colour, and pay duty as follows, namely: All sugar above number thirteen and not above number sixteen Dutch standard of colour, one and three-eighths cents per pound.

"All sugar above number sixteen and not above number twenty Dutch standard of colour, one and five-eighths cents per pound.

"All sugars above number twenty Dutch standard of colour, two cents per pound.

"Molasses testing above fifty-six degrees four cents per gallon.

"Sugar drainings and sugar sweepings shall be subject to duty either as molasses or sugar, as the case may be, according to polariscopic test."

UNITED STATES.

The Future of the Sugar Industry—Reciprocity—Cuba—Sorghum and Beet Sugar.

Communicated by Mr. Santiago Dod to the Fort Scott *Daily Monitor*.

Mr. Santiago Dod, whose name is well known to readers of our journal as an experienced sugar engineer, and valued (occasional) correspondent, has published his views on the above subject in the *Daily Monitor*, of Fort Scott, where he has been staying for the purpose of supervising the construction, at the Fort Scott Foundry and Machine Works, of new machinery for Sénor Serafin Mederos, of Matanzas, Cuba. Mr. Dod's long experience and great practical knowledge add great weight to his opinions, and we are glad to give them publicity, as the proper consideration of the future problems of the sugar trade depends considerably on what will take place during the next few years in the United States. Mr. Dod writes:—

"It will be somewhat difficult for me to comply with your request in a way that will make a technical question interesting to the majority of the readers of the *Monitor*, but I will nevertheless do so to the best of my ability. The rapid development of a great national sugar industry upon a scale commensurate with the demands of a rapidly increasing consumption, has undoubtedly become an imperative necessity to the people of the United States, and all legitimate means should be employed to further the accomplishment of this great undertaking. The agricultural classes upon whose welfare the prosperity of the whole nation more or less depends, are apparently suffering from overproduction. The present depressed condition of your farmers has been brought about in a great measure by two very prominent causes. One was the rapid settlement of the rich lands of the west, which gradually increased the production of cereal crops far beyond your needs at home, while your trade in grain was becoming more and more restricted abroad, partly by the commercial policy which has been pursued, and partly by the course adopted in self-defence by your best foreign consumer. England was too wise to continue paying for her breadstuffs in hard cash without any other return, as you have ruinously been content to purchase your sugar. Many of her products were rejected in

exchange for your grain, and as soon as the opening of the Suez canal made such a relief possible, her eminently wise and practical rulers brought the tillers of the soil in India, who can exist upon a few cents a day, into direct competition with your farmers by encouraging the cultivation of wheat by every legitimate measure within her reach. In 1881, she took from you breadstuffs to the value of $270,000,000, but in 1889 she had gradually reduced her purchase to $124,000,000. If the policy pursued by the United States has saved the working men of your great manufacturing centres from competition with the so-called pauper labour of Europe, it has at the same time brought your farmers face to face with the Ryots of Hindoostan, who are probably the cheapest labourers on the face of the earth.

"A new rival upon our own continent promises to further aggravate this evil. Buenos Ayres exported to England only 6,000 bushels of wheat nine years ago, but in 1888 she shipped 9,000,000 bushels, excluding an equal amount of your crop. From these two sources Great Britain will in all probability soon meet her whole demand. Owing principally to these causes the price of cereals has fallen below the cost of production, and will soon fall still lower. The American farmer must then either learn to live like his Asiatic competitor, upon a dime per day, or look for relief to new sources of profit.

"There are two available means which stand forth prominently for remedying the present agricultural crisis by restoring the old equilibrium between the manufacturing and farming interests. The adoption upon the one hand of the wise system of reciprocity in order to increase the demand for the produce of the farm abroad, and the opening of some new and vast field for the energies of our rural population, in order to enhance the value of cereals at home by reducing production to a normal and safe limit. In regard to the beneficial influence of this new departure in your commercial system, I will only cite the case of the island of Cuba.

"You are now buying from that island from forty to fifty millions worth of her commodities annually, and selling in return but ten or twelve millions in value of your own. Consequently, Cuba alone is costing the people of the United States from thirty-five to forty millions yearly, paid in hard cash, and a very large proportion of this enormous tribute to a foreign people, is drawn from the hard earnings of your depressed agriculturalists, while their products are entirely barred to the inhabitants of that island by the levy of enormous

duties, or their cost so enhanced as to limit the demand to a fifth part of what it might otherwise be. While you take from them nearly all the sugar they produce, an import duty of three or four times its original value is collected upon American flour to protect the producers in Spain, who do not raise enough to supply their home market. The interests of your farmers are thereby sacrificed and bread is made so dear to the Cuban people that it has become a luxury beyond the reach of the labouring classes. If the present duty were removed, consumption would be enormously increased. The larger part of the meat consumed in the island of Cuba is imported from South America, and paid for with the money of your farmers, instead of being purchased from them in exchange for the sugar they buy. Cuba raises only a small portion of the corn she consumes, and the present trade in this grain would also be augmented through the prosperity induced by the free admission of her sugars. The same may be said of canned fruits, shoes, hardware, lumber, furniture and many other products of our soil and factories. Besides all this, large orders for sugar machinery are annually sent to Europe that might be filled in the United States, and probably the Fort Scott foundry which holds patents for important improvements, would get a large quota of this trade, adding very materially to the prosperity of your city.

"A reciprocity clause in the tariff bill would be a blessing to Cuba, inasmuch as it would oblige the Spanish government to relieve her from unwise imposts which are ruinous to her, and of but little benefit to the mother country. Cuba is, in fact, so dependent commercially upon the United States that any improvement in her present condition would result directly or indirectly to the advantage of all classes in this country.

"If we include your new plant among the recognised industrial sources for the production of sugar, you have what no other country possesses—three distinct crops upon which to base a great national sugar industry—the beet, the tropical cane, and the Kansas aspirant—sorghum. There are immense ranges of country throughout the union in which both climate and soil appear to favour the production of these three classes of raw material, opening a field vast enough to make the United States the largest producer of the world. The tests already made encourage the belief that if proper fertilizers are used and as much care bestowed upon its cultivation, the beet will give as large a yield of sugar as it does in Europe, where the best factories

make dividends of from 30 to 50 per cent. upon their original cost. This crop has but one disadvantage. The plant exacts in some respects a treatment more allied to garden than field cultivation. The invention of special implements now used by European producers, however, mitigates this effect to a great extent. The new factory in Nebraska having been very judiciously established in the midst of a colony of Europeans habituated to the cultivation of the raw material, this weak point of previous attemps has probably been avoided. If this enterprise gives the results reasonably expected by its projectors, it will undoubtedly lead to the organisation of many others, and the manufacture will be firmly established in a year or two.

"The production of cane sugar is already a settled industry in Florida and Louisiana, and only requires the adoption of the most improved methods to inspire capitalists with sufficient confidence to induce rapid development. Louisiana, by generalizing the system of large central factories furnished with the improved machinery used by her rivals abroad, could increase her sugar crop from her present 150,000 to 500,000 tons, obtaining as large profits as the best of her German competitors. The southern half of Florida possesses a climate as favourable as that of Cuba for sugar production, and when her drainage system is completed, can maintain as large an area under cultivation as that island is now able to sustain. The cost of production would be less from the simple fact that everything required for a central factory can be obtained cheaper in any part of the United States with the exception of labour, and considering the superior qualities of the American field hand, even this item would in reality be less expensive. The sugar output of Cuba is limited by both the inferiority and scarcity of labour, and this defect is in all likelihood a permanent one, for all the wisdom and influence even of the British government and colonists, have failed in all efforts to induce a natural and voluntary emigration to tropical countries. Public opinion in the progressive element both in Spain and her West Indian possession, is determinedly opposed to further importations of labourers of inferior race. It may therefore be taken for granted that the supply of sugar from Cuba will not, in any eventuality, be much increased except by still more improved methods of cultivation and manufacture. This is also more or less the case in the British island, for although they possess the somewhat equivocal advantage of the yearly importation of coolies from India, the supply is more or less influenced by their natural repugnance to leaving their own

country, and at least four coolies are required to do the work of one good white labourer, because extreme cheapness leads to waste, and because all the work which is accomplished in the United States by ingenuity and the employment of improved labour saving implements, is done by hand where coolies are employed. All this seems to warrant the belief that under the beneficial influences of reciprocity the supply of sugar will not increase as rapidly as many imagine, unless the German products are also admitted free of duty to the United States."

(To be continued.)

BEET SUGAR IN THE UNITED STATES.

The *Deutsche Zuckerindustrie* of October 24th quotes the following from a private letter from Kansas City, dated 12th September, 1890:—

The farmers in Kansas, Nebraska, Texas, and Colorado, and also in California, are busily engaged in giving full attention to beet culture, and adopting it on a large scale, as it will pay much better to grow than wheat.

"At Watsonville (Cal.), there is a beet sugar factory which last year bought 20,000 tons of beets from the California farmers, and paid $5·75 (24s.) per ton. From this quantity 2,000 tons of sugar were obtained. At Hastings (Nebraska), they are creating a large sugar factory. Sugar beets can, as ascertained by Professor Wiley, be grown on almost any kind of land here, and pay the farmer much better than wheat. About 10 tons per acre can be obtained, and at the above price the farmer would get $57·50 per acre for his beets, which would naturally act as an inducement to adopt their cultivation on a large scale. As I wrote you, it is intended to cultivate 8,000 to 10,000 acres in Nebraska in the coming year; in the other States named and in California they have already planted at San Bernardino 4,000 acres with beets, and in Reono and other southern countries large sowings are also being made. Of course the price which can be got for the beets depends on the saccharine content. For those which contain 20% of sugar $5 per ton are paid, whilst those which contain 15% are only worth $3 per ton."

In connection with the above letter we may remark that there is

nothing particularly new in it, excepting the statement relating to the saccharine content of the beets. No doubt cases do occur where there are 20% beets, but they are by no means common, and 13% will be quite as good an average as the inexperienced farmer can hope to obtain. The drop from $5·75 to less than $3 is rather a heavy one. It cannot fail to strike the matter-of-fact Englishman that so many of the statements which appear in American publications and letters are so highly coloured as to be misleading if they are accepted *au pied de la lettre*. All the same our American friends are going to see what they can do in beet-growing, and as Professor Wiley's Report shows, there is great probability that they can make it pay. On the other hand, the average quantity per acre (in California) is 15 tons, *i.e.*, 5 tons higher than that assumed by the writer of the above letter.

A WARNING TO PLANTERS.

Under the above title the *Revista de Agricultura* has found it necessary to advise planters and proprietors of estates to be on the look out with regard to the machinery which they adopt, so as not to subject themselves to penalties for infringement of patents, which may possibly attach to the users as well as the vendors of certain apparatus. The following is a translation of the article:—

"In proportion to the progress effected in the sugar industry in all countries, more perfect machinery continues to be invented for every process of manufacture. It is right that inventors applying a new principle should seek in obtaining a patent to be able safely to fully utilise their invention, and the laws relating to industrial property are justified in protecting this privilege against over-reaching and trickery, conceding to its possessors the right of taking proceedings against any one making use of it without their consent.

"But as it is not possible for a manufacturer, before setting up any particular kind of machinery which may have obtained a patent, to know whether it may not be an infringement of some other patent, and as he may find himself involved in claims which may cause him considerable damage, and finally, as it may suit any one who possesses a patent which has been infringed to allow the infraction of his privilege to be extended to a great number of factories so that he may

afterwards ultimately have a claim to larger sums—it becomes necessary for our manufacturers in general, and our planters in particular, to seek some means to save themselves from the claims and damages to which they may be exposed in using a machine which has been adopted in perfect good faith, and without the least suspicion of the danger they were incurring.

"Many constructors of machinery in the United States insert in their advertisements a note calling the attention of the public to infringements of patents, and others reply that there is no infringement attaching to the patent which they use. Our planters may avail themselves of the hint afforded by this latter statement, and avoid responsibility by adding to the contract into which they enter with the vendors of patent machinery a clause by virtue of which *the constructors of the machinery they are about to set up render themselves directly responsible for all claims which may arise from infringement of any patent.*"

SUGAR, ITS ORIGIN, PREPARATION, AND USES.

Under the above title Mr. Richard Bannister has delivered the first of a series of Cantor Lectures read before the Society of Arts, on sugar, coffee, tea, and cocoa. The lecture, which was delivered on the 28th April, but has only just been published in the Journal of the Society, deals instructively but somewhat superficially with an exceedingly wide subject. This was inevitable where so large a ground had to be gone over in the course of one evening. A great deal of the lecture is intended more especially for those not connected with the general production and commerce of sugar, and would not be adapted for readers of this magazine, and, moreover, is not free from certain inaccuracies, a few of which we may indicate for the benefit of those who may obtain the lecture, which will probably be published separately, to be had on application at the Society's House, John Street, Adelphi, W.C., at a cost of one shilling. As an instance of defective description we may note the remarks respecting the manufacture of Barbados sugar. In place of the following: "It (this sample) has been boiled down over an open fire to the crystallising point, the syrup has then been run into casks for crystallisation, and when the crystals have formed, the casks are turned bung down-

wards for the uncrystallised portion—the molasses—to drain out"—we would suggest after the words "over an open fire," the following as more correct:—"The crystals are formed in the pan and completed in the cooler. The cold mass is put into hogsheads and the molasses drain slowly through holes and crevices in the bottom of the hogshead." We should also question the statement, for which the lecturer is not answerable, as the paragraph is given in inverted commas, that certain rum from Demerara manufactured by a new process of purification "very recently commanded the top price of the market." The statement that the offensive smell of certain imitation Demerara sugars shows they are made largely from beet requires some modification, as there are cane sugars which have a by no means agreeable smell.

Again, in reference to the comparison made between East and West India sugars, the statement that "in the West Indies 70 to 85 per cent. of the weight of cane is expressed" is misleading, 60 to 75 per cent. would be much nearer the truth. Nor is it correct to assume 4 tons of dry sugar per acre as an average out-turn in Barbados. Planters there would be only too happy to get such an average. Nor are the East India raw sugars valueless for refining; bad though the quality and poor though the out-turn may be the comparison between the two countries is not so unfavourable to India as the lecturer makes out.

Again, "refiners' pieces" have not only come into favour with grocers "during the last few years," but over a quarter of a century ago they had a regular sale.

The Strontian process in refining, referred to as not being employed to any great extent, is, we believe, practised on a tolerably extensive scale in Germany.

Some of the tables, such as that on the composition of different qualities of cane juice, are scarcely reliable, but it would not be fair to make Mr. Bannister responsible for matters which can only be thoroughly known to experts, and a lecturer must in such technical matters depend very much on published statistics, which are not always accurate, and possibly not always free from a suspicion of being drawn up with an object.

We think the following remarks on "Bounty-fed sugar: its meaning," which form the concluding paragraphs of the very

interesting lecture on a subject little known to the general public, will prove of value to our readers :—

"BOUNTY-FED SUGAR: ITS MEANING.

"From what has been said when dealing with the classification of sugars for duty, it is evident that different descriptions of sugar, as well as many of the same kind, vary greatly in composition. As long as raw sugar was consumed as such, the variations in its composition were not so apparent as when much of it was refined and exported to other countries.

"To enable the home manufacturer to compete fairly in foreign markets, it is the rule that the duties which have been paid on the goods exported shall be returned at the time of shipment, and this return of duty is called the drawback.

"When such goods are exported in the same condition as they were in when the duty was charged, there is no difficulty in granting an equitable drawback.

"If, however, the goods be charged with duty in one condition and exported in another, there is considerable difficulty in assessing the drawback, and this is the case with refined sugar.

"The duties on the raw sugar are, in the case of beet, levied on an assumed yield of sugar from a certain quantity of roots or juice, and in the case of raw sugar, on the quantity of refined sugar a certain weight is supposed to yield.

"In practice, the *real* is greater than the *estimated* yield, and as a consequence there is a certain quantity of refined sugar produced, on which no duty has been paid. If this excess quantity be consumed in the country of production, the sugar refiner benefits at the expense of the home consumer, the price charged for the duty-free sugar being the same as that on which duty had been paid. If, however, any portion of this duty-free sugar be exported, the exporter receives from the State the duty which should have been paid on the sugar by the refiner, which is, to all intents and purposes, a present to him from the taxpayers of the country through the Government. This bounty is generally applied by the exporter in underselling his foreign competitor, and the rivalry thus created forces down the price of sugar, and enables the consumer of the foreign sugar to participate in the gift made to the exporter by the taxpayers in the country of its origin.

Calculated Bounty on Sugar.

	France. (1887.)	Germany. (1888 Law.)	Belgium. (1887.	Holland.
1. Total production of sugar ....(tons)	555,000	90,000	150,000	36,000
2. Estimated proportion of surplus sugar manufactured to total (1)	36½ per cent.	25 per cent.	20 per cent.	16 per cent.
3. Amount of surplus sugar •................(tons)	200,000	250,000	30,000	6,000
4. Rate of duty	50 frs. per 100 kilos., +10 frs. on all sugars.	10/3 per cwt.; viz., 6/- on all finished sugar, and 4/3 on the roots.	45 frs. per 100 kilos.	27 fl. per 100 kilos.
5. Estimated total loss of revenue from surplus sugar escaping duty......................	£4,000,000	£1,000,000	£550,000	£162,000
6. Estimated bonus on production, dividing total loss of revenue by quantity produced	£7 4s. per ton.	£1 per ton.	£3 13s. per ton.	£4 10s. per ton.
7. Total sugar exported ....(tons)	159,000	619,000	111,000	96,000
8. Apparent bonus on export, dividing total drawback on surplus sugar exported by total quantity exported......................	£3,180,000, or £20 per ton.	£1,000,000, or £1 12s. per ton.	£550,000, or £5 per ton.	£162,000, or £1 14s. per ton.
9. Estimated bonus on production, dividing total drawback on surplus exported by quantity produced............................	£5 14s. per ton.	£1 per ton.	£3 13s. per ton.	£4 10s. per ton.

"To show how this system of drawback works, a study of the following table prepared by the Board of Trade will appeal to the understanding much more forcibly than any words of mine can do; because the quantities of surplus sugar made are given, and the amount of money which is taken out of the pocket of the taxpayer as a present to the sugar refiner.

Calculation of Bounties.

	Total Bounty on Export.	Rate per ton on Surplus Exported.	Rate per ton on Production.
	£	£ s. d.	£ s. d.
France	3,180,000	20 0 0	5 14 0
Germany	1,000,000	1 12 0	1 0 0
Belgium	550,000	5 0 0	3 13 0
Holland	162,000	1 14 0	4 10 0
Austria-Hungary	500,000	Bounty does not arise on export surplus.	

"The figures given show how heavily the countries named are taxed to favour the sugar refiners, or rather to encourage the home manufacturer of sugar. In a young and rising country such protection may be excused, because it fosters home trade, and enables different manufacturers to be profitably established at home. But on the other hand, it cannot be denied that such favours granted to those engaged in any special manufacture must be made at the expense of the general taxpayer, who derives comparatively no benefit from the concession: that bounties when given have a tendency to increase the cost of production and to limit improvements in manufacture, to foster the maintenance of large profits at the expense of the general community, and to destroy legitimate competition, which has proved so beneficial to improvement in manufacture, and the lowering of prices to the consumer.

"The experience of the past and present confirms these views, and we may close this lecture with an apt quotation from McCulloch on the subject under consideration:—'The history of all businesses carried on in this country by the aid of bounties proves that they are hardly less disadvantageous to those engaged in them than to the public.'"

THE DIFFUSION PROCESS IN CUBA.

By George Stade.

Based on reports contained in the *Revista de Agricultura.*

Under the above title there has just appeared a report in Spanish on the results of working with diffusion in the campaign of 1889-90, which, considering the importance which may attach with regard to the sister industry in Europe to the success of the Robert Diffusion Process in cane sugar factories (as has already been found in other countries than Cuba), is all the more noteworthy, inasmuch as figures on this subject based on practical working have with few exceptions been hitherto only rarely published. So long as no exhaustive material is available, every contribution to our information must, therefore be welcome, even though it lay no claim to completeness.

It is well known that the large estate owner, Count Ibanez, had two diffusion batteries erected at the end of 1889 in his factories "Joaquin" and "Montana," by the Compagnie de Fives-Lille of Paris. For various causes the working in these factories was so miserably defective, that the Count brought an action against the Company, asserting that they had by no means fulfilled what they had undertaken and promised, whilst the manufacturers, on the other hand alleged that the management of the factories was the obstacle to the proper working of the process. After a long dispute and the legal declarations and reports which are unavoidable in that country, both parties finally came to an agreement a short time ago. The Company having regard to their own business interests has given in, and undertaken to have everything in order ready for the next campaign, and they have probably been mainly led to this by the good results which have been obtained with diffusion in another Cuban factory, for whilst the above estates could only get along with much care and trouble, the Caracas Central Factory had been working to general satisfaction from the outset.

Although in the course of the crop some figures had been published respecting the working of diffusion on the latter plantation, it is not until now that we have exact details from the laboratory of the factory, which may be studied with interest by planters and manufacturers.

The figures which are now published comprise the period from the 16th February to the 27th April of the present year, sufficiently long to furnish us with a formal criterion of the industrial value of the process. Of course there were at the beginning certain irregularities, as is the case with almost all new apparatus. These, however, were only of a secondary character, and were completely overcome after a few days, as soon as the staff of workmen became sufficiently acquainted with the working.

The following tables contain extracts from the results published. Everything immaterial is left out of the consideration, and the figures are given as is usual in European statistics of the kind.

TABLE I.

Composition of the Cane Juice in regard to the Cane worked up.

Dates of Working.	Spec. gravity of juice.	Percentage (brix) of juice.	Degr. Bé of juice.	$C_{12}H_{22}O_{11}$ per cent. on juice.	$C_6H_{12}O_6$ per cent. on juice.	$C_6H_{12}O_6$ per cent. on $C_{12}H_{22}O_{11}$.	Apparent purity of juice.	$C_{12}H_{22}O_{11}$ per cent. on cane.
16/2 to 2/3	..	..	..	..	..	..	..	..
3/3 to 18/3	..	..	..	..	..	..	..	..
21/3 to 27/3	1·0891	21·3	11·76	17·55	1·45	9·8	82·40	14·71
28/3 to 3/4	1·0879	21·0	11·63	17·21	1·53	10·5	81·95	14·46
4/4 to 27/4	1·0873	20·9	11·58	17·94	0·99	6·6	85·94	15·05

TABLE II.

Working of the Diffusion Batteries.

Dates of Working.	Diffusors filled.	Diffusors per day.	Charge per diffusor, in kilos.	Exhausted chips per cent. of cane.	Yield per cent of saccharose in cane.	Loss per cent. of saccharose in cane.
16th Feb. to 2 March..	..	..	..	..	..	..
3rd March to 18 March	..	..	..	..	..	..
21st Mch. to 27 Mch...	475	79	2769	0·67	95·45	4·55
28th March to 3 April	485	81	2753	0·65	95·51	4·49
4th April to 27 April ..	1781	89	2635	0·59	96·19	3·81

TABLE III.—*Analysis of the Diffusion Juice.*

Dates of Working.	Specific Gravity.	Per cent. Brix.	Degrees Bé.	$C_{12}H_{22}O_{11}$ per cent. of juice.	$C_6H_{12}O_6$ per cent. of juice.	$C_6H_{12}O_6$ per cent. of $C_{12}H_{22}O_{11}$	CaO added per cent. of juice.	Apparent purity of juice.
16/2 to 2/3	..	..	..	..	..	..	..	..
3/3 to 18/3	1·0541	13·3	7·35	11·76	0·48	4·16	..	88·49
21/3 to 27/3	1·0547	13·4	7·44	11·26	0·99	8·80	0·050	84·10
28/3 to 3/4	1·0553	13·6	7·51	11·33	0·97	8·50	0·040	83·23
4/4 to 27/4	1·0536	13·2	7·25	11·50	0·63	5·50	0·050	87·12

TABLE IV.—*Composition of the Masse-cuite.*

Dates of Working.	$C_{12}H_{22}O_{11}$ per cent.	$C_6H_{12}O_6$ per cent.	$C_6H_{12}O_6$ per cent. of $C_{12}H_{22}O_{11}$	CaO per cent.	H_2O per cent.	Actual Purity.
16 February to 2 March	..	..	..	..	..	..
3 March to 18 March	80·72	3·37	4·17	..	..	86·70
21 March to 27 March	76·30	6·78	8·88	0·304	6·04	81·20
28 March to 3 April	77·40	6·47	8·40	0·312	5·96	81·80
4 April to 27 April	79·50	5·12	6·40	0·300	5·72	84·20

TABLE V.—*Yield.*

Dates of Working.	Cane worked up in metric tons.	Cane worked up per day, metr. tons.	1 Masse-cuite obtained, metr. tons.	1 Masse-cuite per cent. of cane.	1st jet sugar (96%) in metr. tons.	1st jet sugar per cent. of cane.	1st jet sugar per cent. of 1 masse-cuite.
16/2 to 2/3....	2570·000	210	..	..	268·565	10·45	..
3/3 to 18/3....	2949·537	230	514·035	17·42	342·146	11·60	66·56
21/3 to 27/3....	1315·345	220	227·724	17·31	147·318	11·20	64·68
28/3 to 3/4....	1329·973	220	227·411	17·09	143·238	10·77	63·02
4/4 to 27/4....	4693·673	260	834·609	17·78	533·532	11·35	63·83

TOTAL RESULT.

	Metric Tons (2,204lbs.)
Cane worked up	12,858·528
Charge of cane for each diffusor	2·685
Masse-cuite per 100 tons of cane	17·400
Sugar of 1st jet ,, ,, ...	11·160
,, ,, ,, of masse-cuite	64·93

It is further stated that the cane contained on the average 14·73 per cent. of saccharose. Assuming, in the first place, that this figure was arrived at by direct analysis (alcohol extraction) and not by calculation, and in the second place, that the average of the analysis of exhausted chips was 0·645 of saccharose per cent. of the cane, as stated, then we have a yield by diffusion of 95·7 per cent. of the saccharose in the cane.

		Per cent. on the Cane.
Further we have of 1st jet sugar..		11·16
The manager of the factory estimates	2nd sugar at	1·26
	3rd sugar at	0·50
The total yield of 1st, 2nd, and 3rd sugar was then		12·92

We may remark here that, according to our experience, the estimates for 2nd and 3rd product are too low.

According to the above figures there were 7·74 metric tons of cane required to produce 1 metric ton of sugar, and 100 parts of masse-cuite gave 74·2 of 1st, 2nd, and 3rd sugar.

The data thus communicated once more confirm the view that the danger of invasion in the diffusion process is completely illusory. Unfortunately we are in this case again without the highly necessary details respecting the coal or wood consumed,—a defect which has been loudly complained of in many similar reports. We are also of opinion that the working of the masse-cuite in this central factory must have been somewhat defective, for with a little more care (that is with a more intelligent method of working) a percentage of 68 to 70 of first product might have been got in centrifugalling, as is the case in so many other factories in Cuba.

(To be continued.)

DIFFUSION IN CUBA.

The *Revista de Agricultura*, after giving a series of tables of the results obtained at the Central Factory of Caracas in Cuba during the period ranging from the 16th February to the 27th April, 1890, sums up as follows:—

However, the yield of 12·91%, obtained from canes of 14·73% of saccharine richness, is perfectly normal, and is in exact proportion to the yields which are obtained from the cane in other countries where diffusion is in regular operation, for we see from the Report of the United States Agricultural Department on the season of 1889-90 which has just closed, that on the Magnolia Estate, in Louisiana, during third season with diffusion, and with canes containing an average of 12·73% of crystallisable sugar, the yield was:—

	Per Cent.
Sugar of first jet........................	7·436
Sugar of second jet......................	2·183
Sugar of third jet	1·035
Total........................	10·654

which the Louisiana planters consider as a complete industrial success, and they are doing their best to increase the number of their batteries.

It is known that diffusion requires certain local conditions for its adoption which cannot be met with on all estates indifferently. Notwithstanding, it may very well be asserted that more than half our estates possess the requisite conditions of water and fuel for the adoption of the system, or in other words that out of the 700,000 tons of sugar produced at present in the island of Cuba, estates producing 400,000 tons might introduce the system.

If we then take into account that with the present machinery the yield of sugar of all jets does not reach an average of 9% for all the works in the island, while diffusion gives 12·91%, the production would be 44% greater, it is clear that by applying this process to the factories producing these 400,000 tons we should get, with the same quantity of cane as is at present ground, 44% or 176,000 tons more, which would represent nine million dollars, without reckoning the reduction in the cost of production which would result from the greater yield.

BARBADOS.

Proposal for a Second Botanical and Experimental Station.

(Extract from an Address presented to the Governor of Barbados by the General Agricultural Society, signed G. C. Pile, President.)

In the opinion of the Society, it is only by the continued and increased application of science to the cultivation of the cane that we can hope it will survive the struggle with the beet. The history of beet shows that it is owing to the adoption of scientific methods of cultivation and manufacture that so great an increase in its saccharine content has been obtained, and so large yields of sugar derived from it. Originally this plant contained only 4% or 5% saccharine, of which it was possible to extract only 2½ to 3%; whereas now it has been so improved by careful cultivation and selection of seed, and the manufacture of sugar from it brought to so great perfection, that it averages 14% saccharine in Germany, frequently contains 15 to 18%, and has reached 22% in Nebraska—and the yield from it amounts in average years to three or four tons of sugar per acre. The rediscovery at Dodds, of what the Hon. J. W. Parris, of Highland, had years ago shown, viz., that the cane will grow from the seed might possibly result in a similar improvement in its yielding capacity. At any rate the experience of recent years has shown that under improved manuring the Bourbon cane is capable of much larger yields than was heretofore thought possible; and there are besides several varieties of canes being cultivated at Dodds which, if when tested in other parts of the island they fulfil their present promise, will exceed the Bourbon, as, for instance, the Queensland Creole, the Rappoe, and the Lahaina; which last, in the Sandwich Islands, is reported to give commonly from five to seven tons (of 2,000 lbs.) of sugar to the acre. So that there is a wide field for improvement in our yields before us if we take steps to gain the scientific knowledge requisite to secure it.

It is imperative on us to spare no cost in our endeavour to increase our yields of sugar per acre. We have seen the beet sugar production of Europe rise from 1,774,545 tons in 1880–81 to 3,500,000 tons in 1888–89. And under the stimulus of last year's high prices we have seen this year's production in Europe exceed that of last year by 844,000 tons. The percentage of beet sugar imported into the United

Kingdom was in 1861 but 5 per cent. of the total import of sugar; whereas in 1889 it had risen to 65 per cent.

And not alone is the European output to be considered. More alarming for us is the rapid progress beet cultivation is making in the United States, which constitute at present our best market. Mr. Claus Spreckles has shown that California is admirably adapted to beet cultivation, and Californian beet has been found to contain 17% saccharine. The Watsonville factory has proved a success. Other factories have been erected. This year the Oxnard Beet Company, with a capital of $1,000,000, are erecting in Nebraska one of the largest beet factories in the world, capable of working 350 tons of beet *per diem*. This huge factory is being erected on the strength of experimental cultivation of the beet in Nebraska which has shown that the beet there grown contains 2% more saccharine on the average than that in Germany, as stated by Professor Wiley. The strides the beet industry is making in America may further be inferred from the fact that in 1887 only 200 tons were produced there, whereas this year it is estimated that 12,000 tons will be produced; and also from the fact that the United States Department of Agriculture has this year imported 50 tons of sugar beet seed, and that between 2,000 and 2,500 farmers have applied for it. And that it will continue to advance is most probable, seeing that the net profit to the farmer is estimated to be from $25 to $40 per acre of beet as against $6·50 to $8·50 per acre of corn. So that even though the labour required for beet be greater than that required for corn cultivation, the profit on the former invites its cultivation. The prospect, therefore, stares us in the face of seeing before long a large part of the American demand met by her home production, with the inevitable result that prices will be further forced down. So that, unless we can produce our sugar at lower cost even than at present, we shall be driven to the wall. And only by improving our yield can we further reduce the cost of production, and our only means of doing this is by the aid of science.

The Society would therefore urge on the government a wide extension of the system of experimental stations, in the behalf not alone of the planting interest, but of the whole community. The sugar industry is our great industry. On this one staple the upkeep of our institutions depends. We have no other product to export—nothing else to give in exchange for the imports we need. The industry itself, if it can be successfully maintained as the Society

believes it can be by strenuous effort, is the best possible for us, affording as it does steady and continuous employment to our dense labouring population, and the Society have only to recall the experience of the crisis of a few years since to make evident how serious a calamity it would be for us if ever we should cease to be able profitably to continue this industry.

This extension should, the Society thinks, begin with the establishment of a large and well provided central experimental and botanical station for the main purpose of scientific research and acclimatisation of imported plants, and later small experimental fields should be maintained in various parts of the island, to be as in France, "not so much stations for research as fields of illustration of the good results of improved processes, seeds, manures, &c."—From the *Barbados Agricultural Gazette and Planters' Journal.*

PRESENTATION TO MR. TOM NEILL, GREENOCK, BY THE SCOTTISH SUGAR REFINERS.

A largely-attended meeting of the Greenock and Glasgow Sugar trade assembled in the Tontine Hotel, Greenock, on the 25th September, on the invitation of the Scottish Sugar Refiners' Association. The occasion was the presentation to Mr. Tom Neill of a handsome walnut writing-table by the Scottish Sugar Refiners on his retiral from the honorary secretaryship of their Association, after fifteen years' service. Mr. Robert Kerr, senior partner of the Glebe Sugar Refining Co., and President of the Scottish Sugar Refiners' Association, occupied the chair. Amongst those present were the guest, Mr. Tom Neill; Mr. Robert Mason, of the Roxburgh Street Refining Co.; Mr. H. W. Walker, Mr. Hugh Richard Walker, and Mr. J. W. Walker, of John Walker and Co.; Mr. John Neill and Mr. George D. Neill, of Neill, Dempster, and Neill; Mr. R. R. Paterson, of the Cartsburn Sugar Refining Co.; Mr. Andrew Stewart, of the Orchard Sugar Refining Co.; Mr. A. P. Lyle, of A. Lyle and Sons, London; Mr. Methven, President of the Clyde Crushed Sugar Dealers' Association; Mr. T. P. Finlay, of J. and G. Macdonald, Glasgow; Mr. Alexander Hamilton, of Alexander Hogg and Co., Glasgow; Colonel Ross, Mr. James Dunn, Mr. J. Hope Gordon, of Fraser, Gordon, and Co.; Mr. Alexander Walker and Mr. J. Jarvie,

of Czarnikow and Co., London and Glasgow; Mr. R. F. Blair, of J. V. Drake and Co., London and Greenock; Mr. Campbell, of William Connal and Co., Glasgow; Mr. J. M. Hutcheson, of Macdonald, Hutcheson, and Co., London and Greenock; Messrs. W. G. Harvey, D. Brand, Robert McKirdy, Joseph L. Adams, Lyon, Walton, John Anderson, of John Anderson and Co., Greenock; J. R. Smart, John Leitch, &c.

The CHAIRMAN intimated letters of apology for absence from Mr. J. G. Thorburn, Messrs. Alexander and Joseph Scott, ex-Provost Binnie, of James Richardson and Co., and Mr. Robert Grieve.

The CHAIRMAN then gave the toast of the Queen and Members of the Royal Family, which was loyally responded to.

The CHAIRMAN, who was received with applause, said: Mr. Croupier and gentlemen,—You are all aware of the object for which we are met this forenoon, and on behalf of the Scottish Sugar Refiners' Association I have to thank you for kindly joining with us in doing honour to one who has for so long a time discharged so faithfully the duties of hon. secretary to the Scottish Sugar Refiners' Association, and who is retiring from this office owing to his having ceased to have any connection with the sugar trade. The duties of the hon. secretary during the long period (over fifteen years) Mr. Neill has been in this office have been of an unusually arduous nature, for during the entire period, besides the ordinary work that falls to be performed by an hon. secretary of an association of traders, of itself laborious enough and demanding a large sacrifice of one's private time, Mr. Neill has given an amount of time that I think none of us have any adequate conception of in connection with the efforts that have been made by our trade in order to induce foreign countries to abolish foreign State bounties, condemned by most people, and, I think, defended by none, in our country; so that the trade in which we are all interested, and on which the prosperity of our town so much depends, may recover something of its old vitality. That these efforts have not been successful so far—and I frankly admit our prospects of getting those bounties suppressed are not encouraging—Mr. Neill cannot be held responsible, for nothing has been left undone by him to secure the object he had at heart. I do not wish to enter at length into a history of the bounty question—the subject is one that is known to you all—but it would be impossible on such an occasion—when our association is recognising—I might say when our trade is recognising—for the first time, I think—

at all events, for the first time in a tangible form and in a formal manner the great services rendered by Mr. Neill—not to touch, however slightly, a question the solution of which is so vital to the industry we are all connected with, and a question Mr. Neill expended so much time and devoted so much of his talents to solve while he occupied the position of honorary secretary to our association. That State bounties are unjust and that private enterprise cannot compete with the exchequer of a State are admitted by all, and on the eternal principle of justice both the political parties in this country have opened up negotiations with a view to getting these bounties withdrawn in order to allow our refiners and colonial growers to compete on fair and equal terms with the manufacturers and growers of Germany, Austria, France, Holland, and Russia, the principal sinners in the matter of giving State bounties on sugar. After many years of unrewarded toil we had hopes two years ago that at last what we had worked for would be accomplished, for in Baron Henry de Worms we found one who undertook to champion our cause. After referring to the negotiations entered into by Baron de Worms and the results of the Conference, Mr. Kerr said that after the dissolution of the Conference the most of us, although we have not abandoned all hope, must say that our hopes have been sadly blighted. Now, gentlemen, I started by saying that I did not intend to make an anti-bounty speech, and I have touched as briefly on the question as I possibly could, for this is a question that has engaged the attention of the trade for many years, and it is impossible for me to convey to you—I doubt if I am myself acquainted with the enormous amount of work that has been undertaken in connection with this matter alone by our friend, Mr. Neill, the immense amount of correspondence with the hon. secretary of the London and Liverpool Association of Refiners, his letters to the newspapers, the able pamphlet which he published, and which was widely circulated and read, his mission to America with Mr. Lyle, jun., and Mr. Charles J. Crosfield, of Liverpool, a mission crowned with success—these have all made demands upon Mr. Neill's time; and I am sure to accomplish what he has could only have been effected at a great sacrifice of social and domestic comfort. It is, therefore, I think, fit that the association for whom he acted so long as hon. secretary, and in whose interests he so freely gave of his time, should show, as they are doing to-day, that they are appreciating his services, and recognise the eminent services Mr. Neill has rendered. It is fifteen

years of faithful work and unwearied efforts to promote the best interests of our association that we are called upon to recognise, and I am sure every member of our association is deeply sensible of the great debt of gratitude Mr. Neill has put us under to him; and, before handing over the writing-table—the shape in which we are going to express in a tangible form our thanks for all his work on our behalf—I may just crave one minute, for I feel that I cannot allow the opportunity to pass to express personally my deep regret, as well as that of my brethren, that Mr. Neill is retiring from the hon. secretaryship of our association. It has been my great privilege to be associated in later years, more than any of my brother refiners, with Mr. Neill, for as chairman of our association I was brought more closely in contact with Mr. Neill, and our trade duties brought us much together, and I therefore can bear personal testimony to the consuming zeal, I might say, with which Mr. Neill undertook, and how untiring he was in the discharge of his duties. As a colleague he left nothing to be desired. I deeply regret that circumstances will deprive us of his more active services, for I feel sure, although not now connected with our trade, Mr. Neill will be at all times ready and willing to give his former trade friends the benefit of his advice on matters on which he is so well qualified to give counsel. Mr. Neill, it is now my pleasure to ask your acceptance, from the Scottish Sugar Refiners' Association, of this writing-table, as the inscription says: "Presented by the Scottish Sugar Refiners' Association to Mr. Thomas Neill, on his retiral from the honorary secretaryship of their association, as a mark of their high appreciation of his valuable services and of the efforts he made for the removal of the foreign State bounties on sugar.—Greenock, September, 1890." And allow me to express the wish, as I utter the prayer, that you may be long spared in health to sit at this table, which will recall, I have no doubt, the labours you performed for the Scottish Sugar Refiners' Association. I have to ask you, gentlemen, to drink to Mr. Neill's health.

Mr. Tom Neill, on rising to reply, was received with loud and prolonged applause, he said, I can assure you that I am not merely using conventional phraseology, but am reproducing my inmost thoughts when I say that I deeply regret that my powers of speech are utterly inadequate to convey to you what I feel on the present occasion. I cannot in fitting words say how much I thank not only the sugar refiners, but also the raw sugar brokers and the refined

sugar dealers, indeed, the whole trade, for the kind and valuable assistance which you rendered to me during my term of office, and which helped very much to lessen my labours and render them comparatively easy. I cannot sufficiently thank you for the kind and generous forbearance with which you overlooked my many shortcomings and imperfections. I cannot find words to express to you, sir, my thanks for the very kind way you have spoken of my services, and for the—I am afraid—much too flattering terms you used. I thank you all for the enthusiastic manner you endorsed what the chairman has said about me. Above all, I thank you for the more than handsome and tangible means which you have taken to show your appreciation of my labours and your approbation of my conduct during the time I acted as Honorary Secretary of the Scottish Sugar Refiners' Association. I accept the gift with great pleasure and with deep feelings of gratitude, and I trust that the words which you have inscribed on the writing-table will ever remind me and mine that "the path of duty 'is not only' the way to glory," as the Laureate says, but is also the road to the esteem and approbation of our fellow-men,—of men whose esteem and approbation I consider it a very high honour to be thought worthy of receiving. You have alluded to my labours on the Sugar Bounty Question, and I confess that was the principal duty that devolved upon me during the time I had the honour to hold office. I had to take an active part in the battle which the British sugar refiners and the British sugar producers were waging on behalf of free trade, on behalf of the British sugar trade being allowed to sell their goods on British markets at the free trade price, and against the Protection which the foreign sugar producer and sugar refiner enjoyed on British markets owing to the operation of the foreign State bounties on sugar. You have said that only lately was there a slight success for all the long years of labour. On more than one occasion, indeed, on many occasions, was victory almost within our grasp. For instance, in 1876, the Government of Lord Beaconsfield concluded a Treaty between this country, France, Belgium, and the Netherlands, by which these countries agreed to abolish bounties on sugar; but, unfortunately, owing to the want of foresight on the part of the majority of the Dutch Chamber, that Treaty was not ratified. Again, as you, sir, have said, in 1890, owing to the laziness of a number of members of our House of Commons in not acquiring a knowledge of the rudimental facts and elementary arguments of the question, the Treaty which the Govern-

ment of Lord Salisbury had negotiated with the leading sugar-producing Continental Powers has had to be relegated for a time to the limbo of the official pigeon-hole. I confess that I am not sanguine of its re-appearance this Parliament, and what may happen during the next Parliament no human being can confidently predict. I should like to say, before sitting down, that, although I have ceased to have any direct interest in the sugar trade, I shall at all times be most happy, and ready, and willing to do anything in my power to further the interests and promote the welfare of the sugar trade. May I express the hope that some unforeseen event may soon happen that will dispel the dark clouds that are hanging over the sugar trade at present, so that it may once more bask in the sunshine of commercial prosperity.

Mr. John Neill (who acted as Croupier) proposed "Prosperity to the Raw Sugar Trade," which was replied to by Mr. J. M. Hutcheson, in the unavoidable absence of Mr. William Wilson, of William Connal and Co.—Mr. Robert Mason proposed "The Clyde Crushed Sugar Dealers' Association," to which Mr. Methven replied.—Mr. Alexander Hamilton proposed "Prosperity to the Greenock Refiners, and a speedy abolition of all Foreign State Bounties." Mr. H. W. Walker replied.—Mr. Tom Neill gave "The Chairman," and Mr. Kerr having replied, the meeting terminated.

DEFECATION OF CANE JUICE BY ELECTRICITY.

By Seaforth M. Bellairs.

It is now a good many years since the influence of electricity on cane juice first became the subject of consideration.

At present it is somewhat of a sore subject, owing to the shameful swindle of a company that pretended to have discovered a method of refining raw sugar into pure sugar, dry, and in one operation, by the supposed influence of electricity. But, because unprincipled adventurers have used the term electricity to cover a swindle, it by no means necessarily follows that there may not be something in the action of electricity which may prove useful to the sugar maker.

By the term "sugar maker," I mean more the maker of sugar than the refiner. The two are not at all the same thing. The sugar maker takes the juice of a plant, generally cane or beet, and extracts therefrom one of its constituents, sugar. The refiner takes raw

sugar and separates the sugar from other substances, which we may call impurities, which are mixed with it, rather than in it.

For instance, yellow sugar, such as Demerara usually exports to England, is really white pure sugar, each crystal of which is covered with a very thin film of a sticky colouring substance; and dark sugar, shipped to the United States, is much the same except that the sticky substance is dark and dirty-looking; there are some particles of dark matter, incorporated inside some of the crystals, but they are shut in more as a fly is sometimes found in amber, than incorporated as copper is in brass.

Therefore the separation of impurities in commercial sugar is not the same process as the separation of sugar from the other constituents of the juice of a plant. And what may answer in the one case need not necessarily be a success in the other.

Let us consider what the sugar maker here has to deal with. It is the stalk of a plant, the sugar cane. If a transverse section of this stalk be made, it will be seen that it is divided into two parts; the circumference and the inside. The circumference is a rind, the juice of which is sap which rises to nourish the plant. This sap consists of substances useful to the plant, that would eventually be converted into sugar by Nature's chemistry, but they contain no sugar yet. The inside is a quantity of cells made of woody stuff, and filled with a clear limpid liquor, which chiefly consists of water and sugar. The spaces between the joints are a mass of cells. At each joint is an eye and a circle of spots. These eyes are the germs of future shoots, and these spots are the germs of future roots, and these are fit for growth, unless, as in ripe canes, they are dried and withered by age.

In fact, the internal economy of the cane reminds one of the arrangement of a honey-bee's hive: the cells of the cane remind one of the combs containing bee-food, while the joints are somewhat similar to the combs containing eggs and larvæ.

The middle of a cane is the sweetest, because it contains the largest proportion of centre cells; and the upper end is the poorest, because it has a large proportion of sap and a small proportion of "cane juice." As the sap is in the exterior, it is advisable to have canes of the greatest possible diameter, so as to have the sap in the least possible proportion to the juice. Provided always that the cane be full-grown and mature, or ripe.

It is easy to prove that canes are divided into parts with different functions. Take two half-grown canes; in one case, scrape off all the

rind, and the head will die. In the other, open the cane and cut out all the inside cells leaving only the rind, and the cane will continue growing as though uninjured. In fact, canes are constantly seen in full growth connected to the root by only a narrow strip of rind.

Canes are brought to the factory and there either crushed in a mill, or sliced up and diffused.

Advocates of diffusion claim that, by that method, the greater portion of the *sap* remains in the chips; while the sugar from the cells passes out dissolved in the water. This may be so, but the liquid obtained by either method is by no means a mixture of water and sugar, exclusive of other substances; there is always a large proportion of sap, and the contents of the cells themselves are not pure sugar and water, but contain other vegetable substances.

In the liquid flowing from the mills, is contained all the sap both from the rind and from any cane leaves that may be mixed with the canes.

The problem is, how to separate all the constituents of this liquid obtained from the cane; to retain the water and sugar, and get rid of all the other substances. When this is done, the water is easily evaporated, leaving only the sugar.

The present method is the addition of an alkali, generally a solution of caustic lime. This, coupled with heat, coagulates the greater portion of the sap, which subsides; most of what remains, on the further application of heat to boiling point, rises to the surface and is removed in the shape of scum.

The result, however, is by no means the desideratum, a mixture of sugar and water; it contains a large proportion of glucose, and also some soluble salts of lime. Right through the subsequent operation of evaporation these salts are present, and it is to be presumed that they continue to do a deadly work and convert crystallizable into uncrystallizable sugar.

Doubtless the "sugar doctors" of the colony have succeeded in largely increasing the recovery of the sugar. This increase is chiefly due to the adoption of the modern method of evaporation at low temperature in *vacuum*. But the polariscope still shows an amount of sugar largely in excess of what is obtained, even when allowance is made for the deleterious action of the glucose which is revealed by the "copper test," and the natural salts found in the ash of the cane juice.

The question is, therefore, whether all or at least a great part of this separation could not be better effected by electricity, which could

not add a foreign substance to the cane juice. Would not cane juice so defecated be more nearly the desideratum, viz., a mixture of sugar and water?

The first experiment in this direction that I ever saw was made at Plantation *Bel Air* many years ago. An attempt was made to filter cane juice through granules of two metals, such as iron and zinc, which were supposed to set up a galvanic action. The result was a beautifully clear limpid liquid; but alas! on application of lime and heat this clear liquid was found to be subject to the usual coagulation, and its beauty was therefore due, chiefly, if not wholly, to the mechanical action of the filtration it had undergone.

Subsequently, Mr. Gill, since dead, devised an apparatus which was tried at Plantation *Hague*, and afterwards, in 1879, at Plantation *Caledonia*, Wakenaam.

This apparatus consisted of an oblong wooden box, which acted as a bath to a sort of galvanic battery, consisting of a square double box, each side of which formed a V. This box was made of zinc, and the sides were smeared with a "patent composition" made, apparently, of a mixture of tallow, iron filings, and some acid. The juice was supposed to enter into this zinc box and to percolate through sand under it (it stood on four short legs), and then to be filtered through diaphragms made of zinc, perforated in large holes, and covered with cloth.

This apparatus may have been a success in the laboratory, but was far too slow for a factory. The sand and filters may, perhaps, have caught impurities, but they so impeded the flow of juice, that, in a very short time, the bath filled up; and the whole arrangement disappeared in a sea of cane juice, and then everything came to a stop till the apparatus was relieved.

Nevertheless, in spite of its defects, and notwithstanding that a large portion of the juice was very imperfectly, if at all, treated by the electricity, sugar was, on one occasion, made without the addition of any lime at all. And, what is even more significant, some of this cane juice, thus treated, was stored in the ordinary liquor vats of the distillery, and this liquor showed no signs of the usual vinous fermentation, which, though undesirable from a distiller's point of view, shows that a radical change in the constituents of the juice had been effected. Unfortunately, the apparatus, with its sand and diaphragms, proved quite unworkable, and it was condemned; and I have heard no more of it.

The failure of this particular plan may have been due to details which could be altered. It seems a pity to let the question drop. If electricity will defecate cane juice, surely the method of the application need present no insuperable difficulties.

Mr. C. Williams, who watched the experiment with Mr. Gill's process, wanted to see if similar juice, without lime, which had not been galvanised, would have crystallized. He thought that the partial success might have been due to an exceptional purity of cane juice at that particular time, and was not to be attributed to any electricity at all. Unfortunately, the experiment could not be tried, as the smallest pan on that estate was so large that failure meant a serious monetary loss.

It seems strange that there is no experimental factory in the colony, a laboratory where experiments could be conducted on a commercial scale—large enough to see how new methods would work in the plantation factories, and yet so small that failure should not cost so very much. The expenses connected with a small factory with a little pan, of half a ton or so capacity, would not be very great; and they might, by arrangement, be divided among all interested, namely, the proprietors of sugar plantations.

Experiments on a large scale, even when successful, are very expensive. The careful weighings and measurings keep back the work; and all the time wages and consumption of fuel go on.

Attached to this small factory might be a miniature estate, of say 50 acres, laid out in plots, or fields, of an acre or so each. In these plots questions connected with agriculture, such as the best system of irrigation, the values of different manures, the advantages of different kinds of canes, and the possibility of obtaining fecundated cane seed, could be solved; and in the experimental factory, experiments could be conducted on such subjects as new styles of mills, diffusion, different systems of defecation, the action of various chemicals on the juice, methods of evaporation, best ways of hanging boilers, &c., &c., besides all the questions connected with the distillery. These questions, which are of the very greatest importance to the welfare of our staple industry, could be solved at small cost. As it is, planters are groping more or less in the dark, deterred from settling many matters by experiments, owing to the great expense and risk attending them.—*Timehri.*

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. THOMPSON, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; and 323, High Holborn, London.

ENGLISH.

APPLICATIONS.

15694. J. H. CARTER and B. CHATTERTON, London. *Improving the action and construction of continuous-feed centrifugal machines.* 3rd October, 1890.

15698. R. A. ROBERTSON (of the firm of the Mirrlees, Watson and Yaryan Co., Limited,) and DAVID BALLINGHALL, Glasgow. *Improvements in apparatus for evaporating, concentrating, and distilling liquids.* 4th October, 1890.

15755. C. E. A. RATEAU, London. *Improvements in fans or blowers, and centrifugal pumps.* 4th October, 1890.

15794. H. H. LAKE, London (communicated by Albert Higgons and Morris Boggs Manwaring, United States). *Improvements in filters.* 6th October, 1890.

16094. J. HASLAM, London. *Improvements in filters.* 10th October, 1890.

16192. A. ESTRAYER, London. *Improvements in filter presses and oil presses.* 11th October, 1890.

ABRIDGMENTS.

10524. THOMAS GAUNT, of Brooklyn, New York, and EUGENE HOWARD CLAPP, of Boston, Mass., both in United States of America. *Improvements in evaporating apparatus.* 8th July, 1890. This invention relates to "in transit" evaporation, and is somewhat similar to the ordinary kind, which has a series of approximately horizontal tubes, over which the liquor flows while under the influence of a more or less perfect vacuum. The invention comprises various structural details, so that an apparatus of large capacity may occupy a small space, and whereby the various parts of the evaporator may readily be inspected, cleaned, and repaired. A spiral or helical motion is given to the liquor, whereby incrustation is lessened or prevented.

16093. W. P. THOMPSON, F.C.S., M.I.M.E., 6, Lord Street, Liverpool, Civil Engineer (communicated by La Société Générale de Maltosa, of 72, de Marais, Brussels.) *Improvements in or relating to a process for the saccharification and fermentation of amylaceous matter.*

12th October, 1889. This invention relates to improvements on Patent No. 5564 (1889), and consists in substituting for the hydro-flouric acid therein mentioned, one or more salts of said acid. The salts preferred are the flouride of ammonium or of sodium, or the double flouride of potassium and sodium.

17018. WILLIAM KEILLER BRUCE, of 3, Grosvenor Terrace, Dundee, N.B., Manufacturer. *Improvements in vacuum pans.* 28th October, 1889. The object of this invention appears to be to provide a vacuum pan which shall be capable of opening or closing without the use of bolts or screws, &c. The pan is constructed with a readily removable cover, which may be raised by means of a pulley or other suitable appliance. A ring of rubber is employed, placed in a recess in the cover joint, to ensure an airtight enclosure.

AMERICAN.

ABRIDGMENTS.

435090. THOMAS GAUNT, of Brooklyn, New York. *Evaporating apparatus.* August 26th, 1890. Chiefly improvements on a former patent to the same inventor, one object of the invention being to so improve the apparatus therein described that liquor can be more thoroughly concentrated. A series of auxiliary chambers is provided into which the liquor under treatment may be passed, and partially treated before passing into the evaporator proper. The action of the apparatus may be made automatic or otherwise.

435747. LEON FRANCOIS HAUHTMAN, of New Orleans, Louisiana. *Diffusion apparatus.* September 2nd, 1890. An apparatus constructed in accordance with this invention is chiefly designed for use in extracting sugar sap from cane sorghum or beet. The material is treated by liquor under pressure in a battery of diffusion pans, each pan having a levered door, and suitable means are employed for circulating the liquor. Details of construction are fully given in the specification.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO SEPTEMBER 30TH.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Germany	4,040,517	4,899,470	3,378,610	2,953,419
Holland	363,666	358,940	305,378	207,697
Belgium	535,749	655,288	372,528	364,960
France	128,436	919,171	113,768	570,491
British West Indies & Guiana	1,496,181	1,096,771	1,424,393	828,892
British East Indies	1,613,335	539,002	1,106,075	278,225
China and Hong Kong	34,916	....	28,040	....
Mauritius	283,283	180,039	280,226	114,939
Spanish West India Islands	49,535	38,000	44,230	28,500
Brazil	701,958	315,431	502,321	191,495
Java	1,519,625	871,658	1,403,737	619,339
Philippine Islands	745,815	228,033	471,980	120,568
Peru	495,435	491,268	420,522	331,179
Other Countries	621,056	281,800	548,683	201,650
Total of Raw Sugars	12,629,507	10,874,871	10,400,491	6,811,354
Molasses	344,319	529,852	128,169	171,392
Total Sugar and Molasses	....	....	16,767,557	12,897,595
Refined Sugars.				
Germany	2,984,863	3,617,680	3,116,654	2,922,791
Holland	923,893	1,372,486	968,661	1,142,058
Belgium	175,374	108,320	188,220	97,680
France	1,225,440	1,897,614	1,326,487	1,543,963
United States	9,896	245,304	9,560	204,805
Other Countries	627,371	4,236	629,315	3,552
Total of Refined	5,946,837	7,245,640	6,238,897	5,914,849

EXPORTS.—Refined Sugars.

	Cwts.	Cwts.	£	£
Sweden and Norway	53,624	48,336	49,076	35,676
Denmark	88,509	105,005	72,403	64,691
Holland	66,546	70,017	56,785	49,651
Belgium	18,924	22,599	14,471	15,691
France	5,308	4,762	4,220	3,104
Portugal, Azores, & Madeira	53,384	62,559	45,463	41,822
Italy	62,504	63,801	56,256	43,361
Other Countries	103,962	165,202	96,123	125,767
Total of Exports	452,761	542,281	394,797	379,763

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of September, 1890, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1887, 1888, and 1889, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				Sept.	Sept.	Sept.	Monthly Average.				Sept.	Sept.	Sept.	Monthly Average.				Sept.	Sept.	Sept.
	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France.............	1363	1686	2373	3053	873	1245	1393	5099	4855	8596	7488	927	5016	4163	6462	6541	10969	10541	1800	6261	5556
Holland	3780	3267	2294	3045	2869	982	1719	2483	2675	3354	4579	2146	2459	3967	6263	5942	5648	7624	5015	3441	5686
Germany & Austria ..	1347	1510	2573	2616	638	1056	1447	10463	11729	13844	17483	6111	6326	6452	11810	13239	16417	20099	6749	7382	7899
Belgium	592	622	827	363	517	456	312	308	227	225	238	183	125	186	900	849	1052	601	700	581	498
United States	454	8	..	126	..	..	563	2804	157	42	1237	10	11	3744	3258	165	42	1363	10	11	4307
Russia.............	3	..	23	..	..	..	..	452	1959	2015	..	328	567	..	455	1959	2038	..	328	567	..
Other Countries	..	1	239	..	..	55	..	15	2	355	23	8	..	145	15	3	594	23	8	55	145
Total	7539	7094	8329	9203	4897	3794	5434	21624	21604	28431	31048	9713	14504	18657	29163	28698	36760	40251	14610	18298	24091

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

To October 18th, 1890 and 1889. In Thousands of Tons, to the nearest Thousand.

	STOCKS. 1890.	STOCKS. 1889.	DELIVERIES. 1890.	DELIVERIES. 1889.	IMPORTS. 1890.	IMPORTS. 1889.
London	22	50	220	246	193	266
Liverpool ..	46	83	218	243	179	232
Clyde......	13	23	168	188	152	189
Bristol	1	2	51	42	51	38
Total ..	82	158	657	719	575	725

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Report.)

For the four principal Ports. In Thousands of Tons, to the nearest Thousand. For September, 1890 and 1889.

	STOCKS. October 1st. 1890.	STOCKS. October 1st. 1889.	DELIVERIES. In Sept. 1890.	DELIVERIES. In Sept. 1889.	IMPORTS. In Sept. 1890.	IMPORTS. In Sept. 1889.
New York	19	32	46	45	37	34
Boston	2	2	15	3	13	1
Philadelphia....	0¼	..	31	9	27	9
Baltimore	..	..	..	..	..	..
Total......	21¼	34	92	57	77	44
Total for the year..........			969	836	979	837

☞ Errata.—We regret that a clerical error has been committed in the above table in the last three issues; the month should in each case be read one later,—for instance, in the July issue, "May" should be "June," and "April" "May," and so on for the other two. The *figures* are in all cases correct.

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, October 17th, 1890.

Fair Refining.	96o/o Centfs.	Granu-lated.	Stand. A.	Stock in Four Ports.
Oct. 16, 1890.—5 7-16c.	6c.	6⅝c.	6⅜c.	Jan. 1, 1890— 11,169 tons.
Oct. 17, 1889.—5⅜c.	6⅛c.	7¼c.	7c.	Jan. 1, 1889— 32,254 tons.
Oct. 18, 1888.—5⅜c.	6¼c.	7½c.	7¼c.	Jan. 1, 1888— 47,798 tons.
Oct. 20, 1887.—5c.	5 9-16c.	6 11-16¾c.	6 5-16c.	Jan. 1, 1887—102,279 tons.
Oct. 21, 1886.—4 9-16c.	6 3-16c.	5⅞c.	5 7-16c.	Jan. 1, 1886— 57,328 tons.
Oct. 22, 1885.—5 7-16c.	6⅛c.	6⅜c.	6 3-16c.	Jan. 1, 1885— 89,186 tons.
Oct. 16, 1884.—4⅞c.	5½c.	6¼c.	5¾c.	Jan. 1, 1884— 60,900 tons.
Oct. 18, 1883.—6¾c.	7 11-16c	8⅝-11-16c.	8¼c.	Jan. 1, 1883— 50,297 tons.
Oct. 19, 1882.—7⅜c.	8c.	9¼c.	8⅞c.	Jan. 1, 1882— 43,927 tons.
Oct. 20, 1881.—8⅛c.	8¾c.	10c.	9½-⅝c.	Jan. 1, 1881— 66,999 tons.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 30TH SEPTEMBER, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal *entrepôts*.	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
88	15	50	37	2½	13	205½	319	314

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 30TH SEPTEMBER, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal *entrepôts*.	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
1351	510	501	297	51	379	3089	2751	2718

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1890-91. Tons.	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.
German Empire	1,250,000	1,264,607	990,604	959,166
France	780,000	753,078	466,767	392,824
Austria-Hungary	800,000	787,989	523,242	428,616
Russia	530,000	465,000	526,387	441,342
Belgium	200,000	221,480	145,804	140,742
Holland	50,000	55,813	46,040	39,280
Other Countries	75,000	80,000	87,000	79,980
Total	3,685,000	3,627,967	2,785,844	2,481,950

Mr. Licht now ventures on an estimate of the probable crop for the current campaign, distinctly under reserve, as it is as yet too early to arrive at anything but an approximate idea.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

During the period over which our present report extends, the market for cane has been quiet; the comparatively small quantities offering have mostly moved off pretty briskly at about the prices ruling when we last wrote. There was good enquiry for lower sorts of brown. The imports of cane sugar into Great Britain for the past twelve months have been very little more than half what they were two years ago, and are likely to decrease still further under the influence of the new United States tariff.

Beet sugar has varied according to the reports of the coming crop, but as there is yet no certainty on this subject, the variation has been small. Prices receded somewhat in the early part of the month, revived again, but the month closes quiet, with quotations decidedly lower than at the end of September. It is likely that we may not see much variation until the new American tariff for sugar is about to come into operation next year. The French manufacturers and agriculturists, with a view to inducing the Government to modify or defer the levying of the new enhanced duties, have raised loud complaints as to defective yield, but it is noticeable that the rough estimates by German statisticians indicate a large crop. The enquiry promptly ordered by the French Government will soon show how far the complaints are based on facts.

Refined sugars are on the whole slightly lower. The *Produce Markets Review* says:—"The difficulties with regard to buying contracts between British buyers and French refiners have now been overcome . . . and the f.o.b. contracts for Continental sugars have now been placed on a much more business-like footing."

Stocks continue to be very low, as compared with the last two years.

Present quotations for the standard qualities, as under, are:—

FLOATING.			Last Month.
Porto Rico, fair to good Refining	13/6 to 14/9	against	13/3 to 14/6.
Cuba Centrifugals, 97°/° polarization	15/- to 15/6	,,	15/3
Cuba, fair to good Refining	13/3 to 12/9	,,	13/6 to 14/-.
Java, No. 14 to 15 D.S...	15/6	,,	15/6 to 15/9.
British West India, fair brown..	12/6	,,	12/9
Bahia, low to middling brown	11/6 to 12/-	,,	11/6 to 12/3.
,, Nos. 8 to 9	12/3 to 13/3	,,	12/3 to 12/9.
Pernams, regular to superior Americanos.	11/9 to 13/9	,,	12/- to 13/9.

LANDED.			Last Month.
Madras Cane Jaggery..	10/9	against	10/9
Manila Cebu and Ilo Ilo	10/6	,,	10/3

Paris Loaves, f.o.b...	16/9	against	17/3
Russian Crystals, No. 3, c.i.f.	Nominal	,,	16/-
Titlers	18/-	,,	18/3
Tate's Cubes..	19/-	,,	19/-
Beet, German and Austrian, 88%, f.o.b. ..	12/9	,,	13/3 to 13/6.

THE SUGAR CANE.

No. 257. DECEMBER 1, 1890. Vol. XXII.

☞ The writers alone are responsible for their statements.

CHANGE OF ADDRESS.

All communications to be addressed to "The Editor of the Sugar Cane, Manchester."

For Table of Contents, see page i.

It seems that in the forthcoming Jamaica Exhibition the United States, which, considering their somewhat intimate connection with the Island, we should have expected to show up in full force, will after all be but poorly represented, and that Canada has come conspicuously to the front, while the mother country and the European States have secured as much space as was available. The fact of the warm interest taken by Canada in the sister colony must be extremely gratifying to all who are soundly assured that there is more than mere sentiment in the conviction that we of Greater Britain possess—and must inevitably possess—something very special in common, something which we value inestimably, and which even our American cousins do not and cannot share to the extent that we do. "Bluid is aye thicker than water," and, come what may, and in spite of misunderstandings and mistakes, it will be long ere the Briton born ceases to look on the native of the Colonies as his own foster brother, or the heart of the Colonist ceases to warm at the thought that he and we are to all intents and purposes one in blood, in language, and in mutual interest.

The Jamaica *Colonial Standard* has a justly severe article on the extremely unfair and ill-tempered remarks of the *Saturday Review* in its notice (September 27th) of the "Handbook of Jamaica," while the same paper alludes with satisfaction to the "pleasant, accurate, and hopeful picture" drawn by Sir Henry Blake in his paper in the *Nineteenth Century*, under the title of "The Awakening of Jamaica."

This very able sketch by a competent hand has, we doubt not, been read with pleasure by many, and we hope those of our readers who have not seen it will take the first opportunity of perusing it. The remarks of the *Colonial Standard* on the way in which the question of the sugar industry is treated are worth reproducing here, agreeing as they do with the general tenor of the opinions frequently expressed in this journal. The writer says:—

"The circumstances and causes that have led to the decline of the great staple industry are clearly and correctly stated by His Excellency Nor can any restoration of the old prosperity be expected save by the adoption of new methods of cultivation and new processes of manufacture. In this journal, we have for years advocated the establishment of central factories, and such division of labour as would make the cultivation of the cane and the treatment of the juice two distinct branches of industry. We have never failed to recognise the difficulties that are in the way of introducing new systems of management, more especially at a time when those who have to pay for the introduction are suffering by the long-continued depression of the sugar industry, caused in a great measure by the operation of the iniquitous sugar bounty. Still, we cannot help saying that sugar cultivation will not be generally profitable till a much larger yield of canes per acre is obtained, and till the percentage of sugar obtained from the juice is very considerably increased."

We would direct attention to the very interesting letter, from Java, on the subject of the discovery of cane seed, by the late Dr. Soltwedel, which will be found among the correspondence at the end of the present number.

On page 633 will be found an extract from a Glasgow paper, describing a new and powerful crushing plant, which has just been constructed by Messrs. Mc. Onie, Harvey & Co., of Scotland Street Engine Works, Glasgow, for the Albion Plantation, Berbice. In connection with this we may also refer to an interesting letter from Honolulu, on the question of diffusion *v.* crushing, which appears in the present issue.

Messrs. John Fowler & Co. (Magdeburg, Prag, and Buda-Pesth) have gained the large gold medal for their steam ploughs, at the Vienna Exhibition, and we notice that Messrs. Ruston, Proctor & Co.,

of Lincoln, have also been similarly successful at the Edinburgh Exhibition.

We learn that the well-known and old-established business of L. Cowan & Sons, Hammersmith Bridge Works, Barnes, London, whose sale rooms are at 7, Mincing Lane, and 34, Fenchurch Street, E.C., was, on the 28th October, converted into a joint-stock company, under the title of L. Cowan & Sons, Limited. No shares will be offered for public subscription.

The directors of the company are:

John Williams, Esq., 28, Lancaster Gate, Hyde Park.
Edward Walter Morrish, Esq., Arundel House, Balham Park.
Frederic Croutel Dobbing, Esq., Crayfield, Chislehurst.
* John Cowan, Esq., Barnes, Surrey.
* Phineas Cowan, Lieut.-Colonel and Alderman, 15, Lancaster Gate, Hyde Park.

* The sole partners in the old firm who will act as managing directors.

The *Bulletin des Halles* states that the Italian Government has been in communication with London with the idea of reviving the discussion of the London Convention in the English Parliament. We think there is little chance of this coming to pass after the outspoken utterances of Baron de Worms.

Our old and well-known contemporary, *The Louisiana Sugar Bowl*, has just entered on its twenty-first year, and reminds its readers that with the exception of *The Sugar Cane*, it is the second in the world in point of age in the English language. We wish for this journal, which rightly claims consideration for its long and valuable services to the agricultural and sugar industries, all the success which we wish for ourselves, and which we trust we shall both continue to deserve. Our own majority was attained on the 1st August, 1889, but we omitted to call attention to the fact.

We have pleasure in calling attention to the advertisement of the Brunswick Technical School for Sugar Manufacturers and Refiners, which appears in this month's issue. We are informed on reliable authority that the course of instruction in this school is most carefully and practically superintended, and we would remind our readers, both in Great Britain and the Colonies, that there is nothing in this

country which can offer any advantages of the kind to be obtained at the Brunswick establishment.

The total consumption of Sugar in the United States as given by Messrs. Willett and Gray, with their remarks thereon, will be found on page 627. At the present moment this is a specially interesting question.

The U.S. Judge Pratt has appointed receivers of the property of the Sugar Trust, and the statement which has been drawn up shows a surplus of some 11¾ million dollars. Quotations for certificates naturally have undergone a sharp fall, but as the plan of re-organisation is not to be interfered with, they are likely quickly to recover.

We continue below our reports on the results obtained by German and other beet sugar factories, as published since our October number went to press. These are, as usual, mainly derived from the *Deutsche Zuckerindustrie.* We have before now alluded to the difficulty of forming anything like an accurate judgment of the real profits, because of the manner in which the latter are divided, in many cases the greater part of this is really included in the price paid for beets to those who hold shares in the company, and are under contract to deliver so many beets of a given quality, in which case the price is usually regulated by the saccharine content. It will be seen that very considerable profits are still being realised, in spite of the comparatively small bounty on what is exported.

Dividends Declared.

Wendessen (capital, M. 367,500), 33⅓%; *Newerk* (capital, M. 1,500,000), 12%; *Trachenberger Zuckersiederei*, 10%; *Haynau* (capital, M. 700,000), 7%; *Alt-Jauer* (capital, M. 1,500,000), 7%; *Stavenhagen* (capital, M. 777,000), 7%; *Oberlausitz* (Löbau), 6½%; *Cönnern* (capital, M. 180,000), 6%; *Klein Wanzleben*, preference shares (M. 1,000,000), 5%, ordinary shares (1,700,000), 4%; *Zuckersiederei Braunschweig*, 4%.

The *Bredow* factory pays no dividend, attributing the poor success to disputes with workmen and consequent higher wages, and to the sudden extraordinary falling off of the sugar content of the beets last season.

The *Badische Gesellschaft für Zuckerfabrikation,* which last campaign paid 14½%, pays nothing this year; the agricultural operations (wheat growing) are partly to blame, and partly the new tax falling on sugar obtained from molasses and passing into consumption.

The *Magdeburg Refinery* pays 6½% on preference and 5½% on ordinary shares. It is expected that the cost of production will be increased during the current campaign, as prices of coal and almost all other articles required in the operations have advanced.

NET PROFITS SHOWN.

N.B.—The figures in brackets indicate the share capital.

Rostock (M. 600,000), M. 235,976; *Badersleben* (M. 473,000), M. 192,919; *Altenau* (M. 450,000), M. 107,365; *Prosigk* (M. 351,000), M. 87,750; *Gronau* (M. 360,000), M. 68,250; *Hornburg* (M. 399,000), M. 100,364; in this case we are not informed whether this is the absolute *net* profit. The reserve fund amounts to M. 80,555. *Wabern* (M. 600,000), M. 171,476; the reserve fund amounts to M. 110,61‥. *Fallersleben* (M. 829,500), M. 184,325; the credit balance in the banker's hands was M. 329,328. *Burgdorf* (M. 421,875), M. 111,573; *Demmin* (M. 750,000), M. 134,852; *Seesen* (M. 371,250), M. 37,248; *Klein Paschleben* (M. 403,500), M. 52,497; *Camburg* (M. 700,000), M. 67,098; *Bahnhof Marienburg* (M. 460,000), M. 33,029; *Vechelde* (M. 300,000), M. 60,829; *Othfresen* (M. 343,200), M. 13,720; *Warburg* (M. 1,063,500), M. 57,359; *Markranstädt* (M. 450,000), M. 22,500; *Göttingen* (M. 259,000), M. 1,036; *Papenteich* (? M. 410,500), M. 42,920; *Ringelheim* (M. 360,000), M. 14,446; *Oestrum* (M. 363,500), M. 15,162; *Garte* (M. 357,000), M. 5,211; *Harsum* (M. 675,000), M. 1,937; *Aderstedt* (M. 989,625), M. 4,553; *Nordstemmen* (M. 525,000), M. 2,131; the reserve fund is M. 135,128; *Weetzen* (M. 750,000), M. 1,377; the real profit is here evidently already divided among the shareholders in the price paid for beets; this is one of the factories which pay according to saccharine content.

LOSSES DECLARED.

Hunfeld (M. 377,700), M. 33,016; *Holzminden* (M. 344,400), M. 5,413; *Sobbowitz* (M. 591,000), M. 1,709.

AUSTRIA.—The Saaz factory pays 10%, and the Lobositz factory 7½%. New factories are announced to be erected at Tlumacs (Hungary) and near Lindenburg (Prussia).

The Hallesche Maschinenfabrik at Halle in Saxony pays a dividend of 32%.

RUSSIA.—It is known that sorghum can be successfully cultivated for sugar-making in Turkestan, and attempts are to be made to establish there a regular manufacture of sorghum sugar.

GERMANY.

PROPOSED CHANGES IN SUGAR LEGISLATION.

Contrary to the opinion we have more than once expressed, and to the general dissatisfaction of all connected with the German sugar industry, and the surprise of nearly all excepting the correspondents of the *National Zeitung* and the *Berliner Tageblatt*, the German Government has after all decided to propose a radical change in the sugar legislation. We are quite at a loss to understand, from a German point of view, the motives of the Government in adopting this course of action, and some of the German papers are compelled to fall back on the hazy assumption of considerations of *haute politique.* As a matter of sound fiscal policy, we can only approve the action of the Minister, for, if a premium is to be paid, by all means let it be an open one, and then the country has no difficulty in knowing how matters really stand. It would appear that the German, like the French Government, has come to the conclusion that the sugar manufacturers have enjoyed quite long enough the very exceptional position secured to them by the legislation hitherto in force. Naturally all parties interested are much excited, and already an appeal has been addressed to the Emperor by the agriculturists of the district of Breslau. However, Germany is after all under semi-despotic rule, and the net result is very likely to be a reply practically equivalent to the historical "Qui qu'en grogne, ainsi sera, c'est ma volonté."

The change is to take effect from the 1st of August, 1892, and the proposal is to establish a simple duty on all sugar passing into inland consumption, and to do away with the duty on the raw material, thus abolishing the existing bounty on export, which is to be replaced by a fixed premium which again is to cease in 1895.

That the change is as unwelcome and inopportune for the interests of the German sugar industry as it was unexpected, may be gathered from the following remarks of the *Deutsche Zuckerindustrie* and the *Telegraphische Correspondenz* of Mr. Joseph Görz. The former says:—

"We are confronted by an enigma, when we reflect that, in those quarters whence the decision comes, it must be perfectly well known that the gain by the duties, which yet remains to the sugar manufacturers from the remnant of the tax on the beets still left by the Act of 1887, is exceedingly small,—that it serves as an indispensable weapon of defence against the competition of foreigners,—that the

tax on the raw material offers to the agriculturist and manufacturer a guarantee for further sound development of their operations,—and that, above all, the yield from the sugar duties has reached an amount never expected by the Government itself.

"What can possibly induce the Government to want to bring about a reform, of which the financial gain would either be immaterial, or if it should attain any importance, such importance must be accompanied by appreciation of an indispensible article of consumption?

"It may sound paradoxical to say so much of a branch of industry on which the well-being of large districts depends, but the sugar industry has become, so to speak, unpopular. It has the reputation of being supported at the cost of others, and of being a continual drain on the Treasury. The 'export premium' for instance, is a *mot d'ordre* which embraces the whole of the financial knowledge and fiscal policy of many a politician, and, unfortunately, of the very people whose business it is to influence popular opinion."

After alluding to the various ways in which the effect of the proposed legislation may be interpreted, the *Deutsche Zuckerindustrie* declares: "However this may be, one thing is certain, that the project will establish regulations that must make the export of German sugar more difficult, and at the same time raise the tax on inland consumption to such a height as to diminish the latter, thus inflicting on the industry two wounds with one stroke,"—and concludes by appealing to the agriculturists to do their utmost to avert the coming danger, it being certain that the sugar manufacturers will leave no stone unturned to expose and overthrow error and show the way back to the right path.

Mr. Görz, in the *Telegraphische Correspondenz*, expresses himself as follows:—

"The news does not surprise us. For some time we have been pointing out both what was coming and also the enormous danger to the German industry of such a project. This is the beginning of the end! The German industry is face to face with regulations, which allow to be clearly seen the fact that the Imperial Government cares little about the maintenance of the German export trade, regulations which, no doubt, seem to secure directly a larger influx to the Treasury, but which will inflict losses on the national well-being that will sweep away completely the extra receipts calculated on. The fact of a period of three years being proposed to be granted for the industry to prepare for the total abolition of the duty on the raw

material is about the same thing, if we may so express it, as cutting a dog's tail off piecemeal. Such a proceeding on the part of the Imperial Government is enough to induce a feeling of desperation, under which we are tempted to exclaim, with Shakespeare, 'Mischief, thou art afoot, take what course thou wilt!'"

Comparing the course pursued by the Imperial Government, which had declined, as we are now informed, to re-consider the project already submitted to the Bundesrath, Mr. Görz says nothing remains now but for the sugar industry and the agriculturists but to appeal to the Reichstag itself, and rather bitterly compares the different action of the German and French authorities as follows:— "On the one hand, we see full consideration shown by the legislative authorities for industry and agriculture; on the other, the interests of the latter sacrificed by a fiscal legislation inexplicable to any one acquainted with the circumstances of the case; on one side, protection of an industry so highly important to the country; on the other, a course of proceeding the effect of which is only to strengthen foreign competition."

UNITED STATES.

OPINIONS OF THE SUGAR PRESS ON THE MC.KINLEY TARIFF.

For many years no fiscal measure has excited so much attention as that lately passed by the United States Legislature and known as the Mc.Kinley Bill, and certainly in the case of none has there been such an immediate reaction from the opinions which led to its enactment. It has been described as "a rampant Protection Bill in regard to almost every commodity but sugar," of which all grades below No. 17 Dutch standard will be admitted duty free, and all kinds of refined above No. 16 will pay a duty of $\frac{1}{4}$d. per lb. after 1st April, 1891. A bounty is granted to home-grown sugar, but a differential rate of $\frac{1}{10}$th cent. is to be levied on sugars imported from bounty-giving countries, such as France, Germany, Austria, &c. England as a non bounty-giving country will probably be able to export refined sugars to America, as there is no chance of the States being able for several years to produce anything like the quantity they will require.

The defeat of the Republicans in the State elections cannot be regarded in any other light than that of a clear condemnation of the Bill, and although the merchant class will object to the unsettlement caused by continual changes, the Republicans, to keep the game out

of their opponents' hands, will undoubtedly shortly commence tentative measures in the direction of altering some of the provisions of the new Tariff. But there does not appear any likelihood of such changes being made in the portion relating to sugar.

As regards the West Indian Colonies, the new legislation undoubtedly means a much larger opening for their sugars unless the Reciprocity Clause should stand in the way. It is as yet too early to judge what can be done in the way of altering some of the heavy customs duties which are in force in many of the colonies, and which would certainly hinder the development of the sugar trade with the States, but there is plenty of room for improvement, and if the various legislatures are wise, they will at once look into the question.

We have thought that a translation of the views expressed in the *Revista de Agricultura* of Havana and the *Propagateur de la Martinique* would be of some service, as the conditions in those islands will to some extent resemble those obtaining in some other parts of the West Indies. The Cuban journal says:—

"The first effect will be the disappearance of those refineries in the United States which have been working up the molasses of Cuba and the Antilles, because as the sugar will enter on the same terms as this secondary product, there will be no *raison d'être* for the process which has formed the profit of such refineries. Consequently this market will be closed to our molasses, which will either have to be sold to distillers, or boiled down in the works for the purpose of extracting from them the greatest possible quantity of the sugar contained.

"We cannot reckon upon the sale to the distilleries, because it is a known fact that our production of alcohols is per force limited by the want of a market to which we can export them, and our molasses, becoming accumulated, will fall to a price which will not pay for packing and carriage."

The *Revista de Agricultura* proceeds to argue that there is no likelihood of the erection of refineries in the island for the purpose of using these molasses, nor will those works in which molasses are now boiled down pay the necessary attention, for the reason that this kind of work is in itself troublesome, that the sugar worker is generally paid only according to the quantity of juice, and more than all, that there is a complete absence of that technical calculation which determines the proper methods required for utilising second products. There is in them nothing left but to reorganise the boiling houses in a manner which will enable them to work up the molasses in a rational manner.

"But the question of molasses is not the only one which, as regards our sugar boiling houses, will be affected by the McKinley tariff. The type (No. 16) of the Dutch standard, which has been adopted, being higher by from 4 to 6 Nos. than the Nos. 10 and 12, which are generally made here, will admit the beet sugars to consumption in the United States, placing them in a privileged position as regards Cuban sugars, if they are continued to be produced in Nos. 11 and 12, as at present, because the sugar of first jet, which in the manufacture of beet is usually white, can easily be brought down to No. 16 without any expense or sensible alteration in the present processes of manufacture, enabling these to enter the States duty free.

In order to compete we shall have to take another course, viz., to make sugars up to No. 16, offering the American market sugar capable of entering into local consumption, and which, the classification according to Dutch standard being the same, will always be preferred by consumers.

We have already works making sugars of No. 13 and 14 for the Peninsula at a profit. These will be the best prepared to produce No. 16, but the generality of our factories, whose careless method of manufacture only enables them to turn out low grade sugars, will have to enter on the path which we have for years pointed out, viz., they will have to organise their boiling houses on a commercial basis, with the laboratory arrangements necessary to keep an exact check on all the details of the manufacture, and alter their methods, adopting a rational mode of working conformable to the various classes of sugar which they will have to make to avail themselves of the benefits of the new legislation."

The *Propagateur de la Martinique* remarks:—

"It would be very difficult, for the present, to say which would be the best for us, to export to the United States raw sugars free of duty but subject to the requirements of the refiners, or to send them white sugars which would pay 6fr. 93c. per 100 kilos. (2s. 9½d. per cwt.), and would pass directly into consumption. In fact, the new law so completely overthrows all the received ideas that we cannot know what will be the difference in future between the two grades; experience and practice can alone teach us.

"What we can tell, and that at once, is that the new legislation is in our favour, and that it has opened up to us a market hitherto closed to our products by a prohibitory tariff. We do not mean to

say that there will always be a great advantage for us in cultivating the American market, because with the existing facilities of communication and transport the various markets balance themselves very quickly and quotations become equalised. By chance it might pay us to do so. The advantages which we do see are that we can treat with the United States as we have hitherto negotiated with France; that we shall have one customer the more, and a most important one; that we shall be able to sell our goods on the spot, getting rid of a great many chance calculations, and these are real advantages."

As regards Continental nations, it is hardly safe to reckon on a considerable increase of exports to the States, as the Reciprocity Clause may well stand in the way; the German and French Governments having up to now steadily refused to favour the import of the American agricultural products, the President may very probably take advantage of this clause to endeavour to obtain concessions, which are not likely to be granted all at once.

UNITED STATES.

TOTAL CONSUMPTION OF SUGAR FOR THE YEAR ENDING OCTOBER 1ST, 1890, AS COMPARED WITH 1889 AND 1888.

From Willett and Gray's Circular.

	1889-90	1888-9	1887-8
Total Stock in U.S., Oct. 1st, 1889-88-87..	149,017	108,298	161,011
Receipts of Foreign Sugar, Four Ports	1,149,528	1,052,907	1,037,296
,, ,, ,, San Francisco ..	124,454	140,569	113,686
,, ,, ,, New Orleans & other Atlantic Ports	17,237	25,307	20,335
Maple, Beet, Sorghum, &c.	25,000	25,000	20,000
Domestic Molasses Sugar	53,282	43,715	42,385
,, Cane Sugar (Louisiana)	128,344	144,878	157,971
Texas and other Southern States	6,500	6,500	6,500
	1,653,362	1,547,714	1,560,184
Less transferred and afloat from San Francisco and New Orleans to Four Ports..	....	613	12,860
Total Supply	1,053,362	1,546,561	1,547,324
Deduct total stock, Oct. 1st, 1890-89-88 ..	78,213	149,017	108,298
Consumption and Export................	1,575,149	1,397,544	1,439,026
Deduct Exports	26,518	8,813	14,677
Net consumption for years ending Oct. 1st, 1890-89-88	1,548,631	1,388,731	1,424,349

The increased consumption for twelve months to October 1st, 1890, was 159,900 tons, or 11½ per cent.

The population of the United States in 1890 is 62,480,540, against 50,155,283 in 1880. The consumption of sugar for the year was 55½ lbs. per capita of population. The consumption in 1880 was 864,000 tons or 38½ lbs. for each person.

SEEDLING SUGAR CANES.

Reprinted from the "Demerara Argosy."

The systematic propagation of the sugar cane from seed is as yet in its infancy, nevertheless some facts of interest and importance have heen discovered which are worth briefly summarising here. Since the time that the rediscovery at Dodd's Botanical Station, Barbados, of the seminal fertility of the cane was authenticated, realising its potential importance, systematic experimental work has been carried on at our own Botanic Gardens, as our columns have before disclosed. That the very earliest varieties of sugar cane can reach maturity the first year of their growth from seed has been shown as possible under favourable circumstances this season at the Botanic Gardens; though, it must be admitted, that even with these very earliest varieties, both the proportion of canes in a stool and of plants to a bed of the same variety which flower the first year is small. Seed of the variety *Karakarawa*, which is one of the two earliest kinds in the colony, was sown on 1st October last year. Three months later the young plants were taken from the seed boxes and pricked out in baskets, five or six in each basket. Six weeks later again they were shifted on singly into larger baskets, which were about six inches deep and wide, and in which they remained till they were from 1 to 1½ ft. high, when, on the 19th April last, they were planted out in the open ground. At that time each plant consisted of a solitary shoot, none having begun to sprout from the base. A few weeks later, however, they began to tiller freely, and to grow rapidly, and by the middle of September a few shoots of the more advanced plants were in flower; thus completing the cycle of growth. As, when they were planted out in the ground, in April, the young plants were only in an equivalent stage to that of a cane top, put into the ground at the same time, the record above given shows that seedling sugar canes of the earlier varieties make rapid and vigorous growth once they get past the tedious period of infancy, which occupies from four to six months. Only, however, the very earliest varieties mature the first year; all the rest, though they may be only a month or so later in their period of flowering, miss the first season of arrowing, and consequently have to go on to the following autumn before the chance of performing that function occurs again; so that for the great majority of varieties it may be said that two years are required from the time

the seed was sown for the seedlings to mature, or from fifteen to eighteen months from the time they were strong enough to be planted out in the open ground. This is a sufficient proof, if any were needed, that the idea of resorting to seed for propagation in field agriculture is impracticable, and that the present methods of propagation by cuttings or stumps will have to be adhered to in the future as in the past, if only for economy in time. But, of course, the insuperable obstacle to using seed in field propagation, even if time could be regarded, as the Indian regards it, as of no consequence whatever, is the delicacy and slow growth of the sugar cane in infancy. In the climate of Guiana, field propagation of the cane by seed would probably not yield an average of one plant per acre. As we have emphasised before in these columns, the only useful way of employing the knowledge we now possess of the sugar cane's seminal fertility, is in nursery propagation, with the object of obtaining new varieties. Of this method of propagation and its results we have now had two seasons' experience, and short as the period is over which the experiments have extended, the information gained is highly interesting and instructive. Numerous facts, naturally of varying importance and practical interest, have been discovered, two of which are of great value because of the promise they hold out of ultimate economic improvement in the sugar cane by this method of propagation. The first of these important revelations is the wide variation that occurs in seminal generation in the sugar cane; and the second the marked tendency to improvement shown in this variation. As was naturally to be expected there are numerous instances of retrogression, but the general tendency is clearly on the lines of improvement in each particular variety that has been so far successfully tested. The progress in improvement is gradual of course, and the degree naturally in direct proportion and relation to the character and quality of the parent canes. The inferior varieties, for instance, do not produce large varieties in a single generation, but, as with the better kinds, few or many of the progeny show a decided improvement on the parent stock. In the majority of instances the improvement, though evident, is not great, but occasionally an instance occurs that is a striking advance. This is the ground of encouragement in pursuing this method of reproduction. If among the seedlings of a variety is found in the first generation a plant twice or thrice the size of the parent plant, we are justified in expecting that by selecting this larger plant and breeding from it again we shall get still further

improvement, to be repeated again and again in succeeding generations. This, we may note, is one of the points already achieved. By recording the name of the variety from which each lot of seed was gathered, when it was sown last year at the Botanic Gardens, this possibility of improvement has been established with certainty, so far as the evidence afforded by a few varieties in a single generation can be taken as a guide, and we know of no reason against its acceptance. We have mentioned the occasional improvement observed in size in the seedlings of these carefully recorded parent varieties; but the variation in colour and form and other external characters is more general and conspicuous than that in size. In the majority of instances there is an evident approximation in physical and morphological features to the characteristics of the parent, but the departure from this typical state covers the entire range of variation possible, from the least to the widest extreme. Of this wide range too many instances have occurred to leave any room for doubt on the ground of possible error of record as to parentage that might arise from mistakes made in gathering and sowing the seed, or in the subsequent course of growth. In many instances the variation is slight, but in several cases purely white or purely green canes have been produced by dark purple ones. We have said that in the majority of the seedlings there is a general approximation to parental likeness, but absolute likeness does not bear a very great proportion to the whole variation. The degree of approximation varies, however, in the different kinds, the smaller inferior canes producing a larger number like the parents than the larger and superior ones. Of one of the larger kinds of which many plants were raised, not one appears to have come absolutely true. This variety, called *Mani*, is a long-jointed claret-coloured cane, and the widest departure it has made in its varied-coloured progeny is to a short-jointed white cane. If this instance stood alone, as we have before intimated, it might be thought that a stray seed of some other kind had got into the stock, but, as we have also before intimated, the several instances of the kind that have occurred are too many to require or to justify resort to any such explanation. It seems not improbable in fact that if any one of the inferior varieties, possessing a fair degree of germinating power, upon which success largely depends, were taken in hand, that by seminal propagation and careful selection from the seedlings, as many varieties, showing as wide a range of size, colour, quality, &c., might be procured from it in a few generations, as all the kinds of canes

collected from all sugar-growing countries, which we now possess, show! This impression, gathered from our brief experience, justifies sanguine hopes of improvement in the future of the varieties we now cultivate, and imposes the obligation of zealous endeavour to realise this improvement. Another encouraging feature of seedling canes is that the features they first present appear not to be their best or permanent ones. During the first two years, at least, the period seedlings have been under observation here, there seems to be a steady general improvement in character. Where the first shoots have been slender, subsequent ones have come double the size, and where in the earlier canes the joints have been short and often bearded, in the later ones they have been long and clean, and a higher gloss and glow have also developed in the colour. So that as two full years are in most instances required for seedling canes to reach maturity, so also this period is necessary for them to develope their true character. The inference may be taken from this that if the cultivation of the seedling canes first discovered in Barbados had been extended, the objectionable features for which they were discarded and destroyed would have disappeared; in which case we should probably not now have to lament the loss in the experimental working of this potent discovery of the thirty years which have elapsed since that time. Though we have described the wide variation and improvement that might possibly be realised in a few years in breeding and selecting from one of the poorer varieties of cane, we have intimated as well that our object—that is obtaining an improved variety of cane to any now existing—would no doubt be earliest realised by breeding from the better kinds. The primary qualities required are—first, large size, to give weight of cane from the fields, and—second, sweetness to give yield of sugar from the canes. These may be regarded as the primary and absolutely essential qualities of a good cane, while it is admitted at the same time there are several important minor qualities, which, though dispensable, are also desirable. These pertain to the habit of growth, resistance to drought, earliness, flowering or non-flowering, degree of itch to the leaves, of fibre in the cane, &c., &c. In selecting breeding stock it must be admitted that we have much to learn on the subject of the transmission of qualities in seminal generation in the cane. We have described to some extent the evidence we at present possess of the considerable variation that takes place in descent in the physical and morphological features of the cane; whether the sweetness will vary to the same extent sufficient time has not elapsed yet

for us to determine. This character is equally as important as that of the size and physical nature of the cane, and in our experimental work demands equal attention and regard. The few analyses it has been possible yet to make seem to point to the fact that external physical variation is accompanied by internal chemical variation. But we must wait another year, till our pedigreed seedlings have matured, before we can speak with assurance on this point. However, the uncertainty need not affect our present action; there can be no question, whether the saccharine quality varies or not in descent, the best stock to breed from is that possessing in largest degree the qualities, separately or combined, of weight of cane and of sugar. There are three possible ways in which we may look for improvement in the sugar cane. We may obtain a variety that will give a larger weight of cane per acre, though it may contain no more sugar per ton of cane than the better kinds we possess now. Again, we may obtain a variety yielding a higher percentage of sugar, though the weight of cane be not increased. This is what has been accomplished in regard to the sugar beet. Thirdly, we may obtain a cane containing both increased yield of cane and of sugar. Which would be the most desirable would depend upon the degree and relative proportions of bulk and percentage of sugar in the cane. Sufficient has been said to show what is to be sought in propagating the sugar cane from seed. We shall not get an ideal cane; but Mr. Neville Lubbock gave the writer one day a rough ideal toward which we may successfully strive. "What we want," said he, pointing to a plantain stalk 15 ft. high and as thick as one's thigh, "is a cane as big as that comtaining 20 per cent. of sugar." Whether we shall ever attain to the size of cane or degree of sugar contents just mentioned may be left to conjecture and the result of future work, but it is along the lines leading to those ends that we confidently look to make progress. The *Scard* seedling gives us an indication of what is possible. This is a plant of unknown parentage and fortuitous birth in Barbados. It was among the earliest natural seedlings discovered there by Messrs. Harrison and Bovell. When an inch or so high, and when nothing whatever could be known of its character beyond the facts mentioned, it was taken by chance from the nursery at Dodds by Mr. Bovell and sent here. It has turned out an entirely unknown variety, and a giant of its race. A few months ago it fell down of its own weignt, when ten canes were broken off which collectively weighed 122 lbs. without the tops. In spite of this loss it is still 18 feet high and 12 feet in girth of stool, possessing 24 canes which will probably weigh when cut 200 lbs., half as many more having been killed by borers,—pests that have been unusually prevalent this year. In a further issue we shall make some remarks on seed sowing this autumn.

NEW CANE SUGAR MACHINERY.

Double Crushing Plant.

The severe competition between "beet-sugar growers" and the "cane-sugar planters" during the last ten years has been such as to force the cane-sugar manufacturers to exercise all their ability to reduce the expenses in their process. Within the last three years they have been successful in reducing their fuel consumption from 25cwt. per ton of sugar made to 5cwt., and in some cases the coal account has practically been nil. This has been accomplished by improving their furnaces, and the better setting of their boilers, with the addition of "triple effect" evaporation. The next point is to see that all the juice is extracted from the canes by more powerful machinery to give better crushing, or by the "diffusion process," that is slicing the canes as done by the beet-sugar manufacturers. This latter process has been on trial for some years back, but owing to the totally different nature of the "sugar cane" from the "beet-root" there are many difficulties in the way, so that the results of these trials have been somewhat contradictory. Mr. Hogg, of Demerara and London, has expended a large sum of money on his West Indian estates in fitting them up with diffusion machinery. He has given the new process his most careful attention, but the result is still doubtful. Mr. Lubbock, of the Colonial Company, Limited, London, made a special visit to the West Indies last year to study this question. He came to the conclusion that diffusion was not yet a commercial success, and decided to try what could be done by improved double crushing, and ordered machinery accordingly from what he considered the most improved system. This machinery we had the opportunity of seeing yesterday, in motion, in the works of the makers, Messrs. M'Onie, Harvey & Co., Scotland Yard Engine Works, in the presence of a number of gentlemen connected with the cane sugar industry. The new plant consists of a powerful horizontal steam engine, having cylinder 28in. diameter by 48in. stroke, fitted with large fly-wheel about 20 tons weight, speed 40 revolutions per minute. This gives motion to a very heavy and strong set of double-power spur-wheel gearing, 26 to 1, which drives the two mills. The first mill consists of two rollers, 32in. by 72in., and one solid steel roller, 25in. by 72in. There is no trash returner in this mill, which is calculated to save about 20 per cent. of the driving power over the ordinary three-roller mill, and is a patent of Mr. Robert Allan,

engineer, of the Demerara Foundry Co., Demerara. The crushed cane from this first mill is elevated by a carrier into the second mill, which has two rollers, 36in. by 76in., the top roller being fitted with improved hydraulic gear, which gives a steady pressure on the roller, and can be regulated at will as may be found necessary. The feeding of this mill is by Young's automatic feed plate, driven from driving pinion of mill. The whole is a strong and well finished piece of work, the shafts and pinions being of steel, and is expected to give an extraction of 74 per cent., being about 10 per cent. over the ordinary three-roller mill. The result should further enable the cane planter to hold his own, as well as keep Glasgow to the front for the manufacture of sugar machinery, with which special industry it has all along been so honourably connected.—*Glasgow Herald.*

BRITISH GUIANA.

Report on Results obtained with Various Manures on the Estates of the Colonial Company, Limited.

We have been hitherto unable, from want of space, to notice this interesting and valuable report, which has been drawn up by Mr. Scard, the chemist of the company, "whose name"—as Mr. Lubbock says in the preface—"is a guarantee of the accuracy of the records of results." Mr. Lubbock says, "I believe these experiments are the first of the kind that have been carried out in the tropics in a scientific manner, and I think the company may fairly take some credit to themselves as having been pioneers in this respect."

The Colonial Company have undoubtedly laid all concerned under a debt of gratitude by the extremely clear and exhaustive manner in which they have laid the whole details of these experiments, which were conducted on a field of 12 acres, divided into 12 sections, before the public.

In plotting out these fields the following arrangement was adopted. Each field, of as nearly as possible 12 acres in size, was divided into 12 equal plots running parallel to each other throughout the entire depth of the field. These plots were then sub-divided into two equal portions by a line running through the field at right angles to the plots. To half of the field thus sub-divided lime was applied, in addition to the respective manures, the effect of the manures, with and without lime, thus being brought out.

The manures were applied as follows, per acre :—

Plot 1.—168 lbs. of Commercial Nitrate of Soda at 90 % refraction, containing 151·2 lbs. of the pure Nitrate=24·9 lbs. Nitrogen, 168 lbs. of Superphosphate of lime containing 25 % soluble Phosphate, or 42 lbs.=25·7 Phosphoric Acid.

Plot 2.—Same quantity of Nitrate of Soda as in 1, but *double* the amount of Superphosphate.

Plot 3.—Double the amount of Nitrate of Soda as in 1, but the *same* quantity of Superphosphate.

Plot 4.—112 lbs. of Sulphate of Ammonia, containing 25 % Ammonia or 28 lbs.=equal 23·06 Nitrogen, 168 lbs. of Superphosphate of Lime, containing 25·7 lbs. of Phosphoric Acid.

Plot 5.—Same amount of Sulphate of Ammonia as in 4, but *double* the quantity of Superphosphate.

Plot 6.—Double the quantity of Sulphate of Ammonia as in 4, but the *same* amount of Superphosphate.

Plot 7.—280 lbs. of Borwick Loffoten Guano containing 10 % Ammonia=23·06 lbs. of Nitrogen, and 32 % Tribasic Calcic Phosphate, or 89·6 lbs.=41·04 lbs. Phosphoric Acid.

Plot 8.—300 lbs. of Ichaboe dissolved Guano containing 9 % Ammonia=22·23 lbs. Nitrogen, also 18 % soluble Phosphate=39·18 lbs. Phosphoric Acid, and 4 % Insoluble Phosphate=5·5 lbs. Phosphoric Acid.

Plot 9.—Same as 1 with the addition of 200 lbs. Muriate of Potash, containing 105·7 lbs. of Potash.

Plot 10.—Same as 8 with the addition of 200 lbs. Muriate of Potash.

Plot 11.—168 lbs. Nitrate of Soda at 90% refraction, containing 24·9 lbs. of Nitrogen.

Plot 11.—112 lbs. Ground Mineral Phosphate, containing 62 lbs. of Tribasic Phosphate=28·4 lbs. Phosphoric Acid.

12.—Unmanured.

The information yielded by the above would thus be from :—

Plots 1 and 3.—The result of increased application of Nitrogen in the form of Nitrate, in the presence of Phosphates.

Plots 1 and 2.—The influence of increased Phosphoric Acid, in the presence of Nitrogen as Nitrate.

Plots 1 and 4.—The relative effects of Nitrogen, as Nitrate and as Ammonia, in the presence of Phosphates.

Plots 4 and 5.—The effect of increased Phosphoric Acid in the presence of Ammonia.

Plots 4 and 6.—The effect of increased Nitrogen, as Ammonia, in presence of Phosphates.

Plots 7 and 8.—Comparison between the effects of dissolved and undissolved Guano.

Plots 1 and 9.—Influence of Muriate of Potash in presence of Nitrogen and Phosphates.

Plots 1 and 11.—Comparison between Ground Mineral Phosphate and Super-phosphate in presence of Nitrogen.

Plots 12.—Effect of Manuring and Liming generally.

We regret being unable to find room for the tables, which extend, including the appendix, over about 50 large and very clearly printed pages, but should advise readers to obtain for themselves the report, which may probably be had from the printers, Eden, Fisher, and Co., 50, Lombard-street, E.C. The general conclusions at which Mr. Scard has arrived are as follows :—

As the experiments, of the results of which the foregoing is a summary, are still being carried on, it would, perhaps, be premature to go deeply into the inferences derivable from the figures at present obtained; but I consider that it may be distinctly concluded:

1st. That Lime alone gives a pecuniary gain, but only to a small extent.

2nd. That Lime, when associated with manures, gives sufficient increase of yield to pay for itself, only when used in conjunction with the larger quantities of soluble Nitrogen in the form of Sulphate of Ammonia,

3rd. That of the Nitrogenous manures, Sulphate of Ammonia, in the greater quantity of 2 cwts. per acre, gives the best results.

4th. That Ground Mineral Phosphate appears to have produced an increased yield, when compared with Superphosphate.

5th. That Guanos, especially in conjunction with Lime, fall far short of soluble Nitrogen in beneficial influence.

6th. That increase of Phosphoric Acid over the minimum employed fails to give satisfactory pecuniary results.

From the above it would appear that the proper course of treatment to pursue for Demerara soils would be to apply Sulphate of Ammonia and Ground Mineral Phosphates, but in this case it would have to be considered whether there would be proper compensation for abstraction of nutriment, and sufficient security against exhaustion, taking into consideration the fact that potash, which is not added under this system of manuring, exists already in considerable quantity in the soils.

There is one point very clearly brought forward by the observations, and this is an extremely interesting one from its antagonism with existing traditions, and that is, that neither lime nor manures produce any perceptible difference in the quality of the juice, and merely affect the weight of cane. It is true that the juice from the unlimed and unmanured plot was slightly sweeter than the rest, containing, on an average 1·69 per gallon as against about 1·60, but this was due rather to the greater exposure to sun from the lesser quantity of cane than from the influence of manures or lime.

As already mentioned, the experimental fields under consideration are still being carried on, and, doubtless, as crop succeeds crop, the conclusions drawn above will become more and more definite.

SUGAR MANUFACTURE IN INDIA.

The following is taken from the *Times of India*, and is an extract from a communication from the Agricultural Association of Poona :—

"Common country sugar is not manufactured in this part of the country except at Kolhapore, as the manufacture does not become profitable if the residual molasses is not utilized for some other purpose. In the Kolhapore State molasses is utilized in the manufacture of country liquor, but under the Government Abkari rules country liquor is not allowed to be distilled from any other substance except mowa. A well-known and enterprising Parsee gentleman of Poona, Mr. Adurji Dorabji Ghaswala, about eight years ago, erected a sugar refinery, combined with a liquor distillery, at Moondwa, near Poona. He produced different kinds of sugar in this factory and sold them in the Poona market. The colour of the sugar was as white as that of the best kind of imported sugar, and in the Poona Exhibition of Native Arts in 1888, a silver medal and a certificate of merit were awarded to this gentleman. We regret to find that the only sugar refinery in the Deccan practically remains closed owing to the refusal of Government of the concession to manufacture rum and sell it claimed by the proprietor on the strength of a promise, made to him by Government. When the factory was established in 1883-84, the Government of Sir James Fergusson promised to allow Mr. Adurji Ghaswala the permission to retail the liquor produced in his factory from the refuse or molasses feft after crystallizing sugar. When application was made to give effect to that promise the Abkari

Department refused to grant the permission asked for, or to tax his molasses rum as country liquor. The Government of Madras and the North-Western Provinces have made concessions to European owners of sugar factories established in their provinces, and we hope that the Government of H. E. Lord Harris will see reasons to grant them to Mr. Adurji, as there is really no chance of the industry thriving here if Mr. Adurji's pioneer enterprise is not properly supported."

The Report of the Nagpore Experimental Farm contains the following :—

"Bone-dust has been found to possess much less fertilizing power than dung, green soiling, or poudrette. Sorghum was grown for sugar-making on two fields, one half of each of which was manured, and the other half left unmanured. The plot manured with 160 maunds of dung yielded 3,424 lbs. of cane, 274 lbs. of syrup and 8 oz. of sugar against 3,292 lbs. of cane, 237 lbs. of syrup and 6·5 oz. of sugar, produced from the unmanured plot. Similarly that part of the second field, which had been manured with 360 lbs. of bone-dust, gave 2,443 lbs. of cane, 147 lbs. of syrup and 3·5 oz. of sugar, against 1,701 lbs. of cane, 124 lbs. of syrup and 2 oz. of sugar, obtained from the unmanured part. It will be observed that dung added only one per cent. to the weight of the canes, but over 15 per cent. to the weight of the syrup. But bone-dust added 43 per cent. to the weight of the canes, and 18 per cent. to the weight of the syrup. In both cases the quantity of crystallised sugar gained from the sorghum syrup was exceedingly small."

THE GIBBS DRYING MACHINE.

This machinery, which is adapted for all manufactures in which the products are required to be dried, and which for several years has been adopted in London and in Australia, Java, and other countries for the drying of sugar and megass, has recently undergone improvements in its application to tea-drying. The Gibbs Patent Pure Hot Air Furnace, after many experiments, has proved a perfect success in supplying the means of obtaining either from coal or wood, or both, a hot air so pure that it can be inhaled without injury or inconvenience, and is therefore suitable for application to the most delicately flavoured tea, coffee, &c., or other produce without possibility of taint. It is now not only possible but easy and economical to obtain the utmost amount of heat from coal without any deleterious

accompaniments. It may interest our readers to learn that most favourable reports have been received from various parts of India and from Natal.

The latest use to which the Patent Drying Cylinders (see advertisement columns) have been successfully adapted is that of coffee drying.

Some months ago Messrs. Gibbs sent out one of their Dryers to a large house in Rio de Janeiro, Brazil, and by the last mail from this country they have been advised that at a public trial held the machine gave great satisfaction, the opinion being that it is the best of the many dryers in the market.

The apparatus in question consists of a horizontal rotating cylinder 36ft. long by 3ft. 6in. diameter, through the centre of which at one end a circular tube or air-duct projects some 12 feet; this tube is open at one end and connected with a fan, which draws a supply of heated air from a specially constructed furnace, capable of burning wood, coal, or other fuel.

The opposite end of the air-duct is fitted with a perforated iron plate through which the heated air-currents are distributed into the cylinder.

Both ends of the cylinder are partially closed with wire mesh discs, which, while retaining the coffee, allow free escape for any vapour.

In the shell of the cylinder are a series of apertures or ports covered by slides.

The modus operandi is briefly as follows :—

The cylinder is first placed upon a slight inclination (a sliding bracket being provided at one end whereby the inclination can be easily adjusted), so that the coffee fed in at the higher end gradually travels down to the opposite or lower end, where it is retained by the wire mesh disc above mentioned.

When the cylinder has been thus fully charged it is set down level and kept continually revolving until the charge is dried, the slides covering the ports in the shell of the cylinder are then drawn out and the coffee rapidly discharged, by again placing the cylinder upon an incline.

It should have been mentioned that the interior of the cylinder is fitted with shelves or lifters, by which the coffee is distributed in a constant shower over the whole area of the cylinder, through which the heated air-currents are passing.

The machine effects an enormous saving in labour, burns very little fuel, is easily erected and worked, and the whole mechanism being extremely simple there is no liability to get out of order, and it is only reasonable to expect that a Dryer possessing such advantages will prove exceedingly popular.

THE DIFFUSION PROCESS IN CUBA.

By George Stade.

Based on reports contained in the *Revista de Agricultura.*

Continued from page 596.

It would then have been easy to obtain a yield of 11·7% (on the cane) of 1st product. Although for this reason we cannot regard as perfectly normal a total gain from such rich material of 12·91% of raw sugar, we will notwithstanding adopt this figure in making a comparison with the official statements of the United States Department of Agriculture. According to the Bulletin of this department the Magnolia Factory (Louisiana), which is also worked with diffusion, obtained from cane of defective quality, viz., with 12·73% of saccharose, the following yield:—

1st sugar per cent. of cane	7·436
2nd ,, ,, ,,	2·183
3rd ,, ,, ,,	1·035
Total sugar of 1st, 2nd, and 3rd jets	10·654

If, now, for the sake of comparison we reduce the two yields to chemically pure sugar, we have

For the Ingenio Central Caracas (Cuba)—

Per 100 of saccharose in the cane about 83 of saccharose in the form of raw sugar, or, calculated direct on raw sugar, about 88 of raw sugar of all jets.

For the Magnolia Factory at Louisiana—

Per 100 of saccharose in the cane about 79 of saccharose in the form of raw sugar, or, also calculated direct on raw sugar, about 84 of raw sugar of all jets.*

It must be noted, however, that such a comparison can hardly be a practical one, as it is well known that the Louisiana cane is considerably poorer than that grown in tropical Cuba. At Magnolia the very large amount of glucose stood in the way of obtaining a higher yield.

---

* Compare also the yields stated to have been obtained (*Deutsche Zuckerindustrie,* 1889, p. 1510), in a raw sugar Central Factory, using a single three-cylinder mill:—

Per 100 of saccharose in the cane—66·351 $C_{12}H_{22}O_{11}$ = 70·661 of raw sugar.

Per 100 of saccharose in the mill juice—85·55 $C_{12}H_{22}O_{11}$ = 91·21.

It is hardly needful to remark that the above figures must afford food for considerable reflection to Cubans more particularly and to owners of sugar plantations generally; but one thing must not be forgotten, that in the tropics the path leading from reflection to action is frequently a remarkably long one, and often much beset with thorns. One thing is absolutely certain, viz., that in the next campaign there will be three factories in Cuba with the Robert diffusion process in full and regular work, and we can already see that decidedly more favourable results than those above stated will be attained with good technical management. It is therefore not improbable that, in spite of the notorious conservative tendency of planters (consequently under the reserve which we have already made), the process may spread more and more, as it is now acknowledged by all intelligent planters in Cuba to be the most important factor in the future of the colonial sugar manufacture. But most of the other cane sugar producing countries have also commenced to move in this matter. In the first rank are Louisiana, Java, Hawaii, Demerara, and Australia. It is natural, as has already been repeatedly pointed out, that the progress of this movement should be exceedingly slow, but in spite of this it deserves to be most carefully noted by those whose interests are concerned.

EXPLOSIONS IN VACUUM PANS AND CELLS OF MULTIPLE EFFECT.

It is well known to those engaged in sugar boiling that a solution of sugar and water left standing for any length of time in a vacuum pan or other vessel will generate spontaneous fermentation, and that during the process of such fermentation a highly explosive gas, or a combination of gases, is generated. If this gas is confined till a sufficient quantity of it has accumulated, and then ignited, it will explode with force enough to blow the strongest vacuum pan into fragments. Explosions have from time to time occurred in vacuum pans and in the cells of multiple effects in the sugar houses on our plantations in these islands, from the gas generated from the "sour water" left standing in the pans for the purpose of softening the scale deposited on the heating coils, drums, etc. But fortunately, in most cases, no more harm has resulted than scorching the skin and singeing the hair of the individual seeking to introduce a lighted lamp or candle through the man-hole of the vessel containing the fermenting liquid.

Recently a more serious accident occurred at the Papaikou Plantation, Hilo, Hawaii, where an explosion of gas in a vacuum pan caused considerable loss of property, and which, under other circumstances, might have caused a serious loss of life as well. A large vacuum pan, capable of striking seventeen tons of sugar, had been standing for about three days with a fermenting liquid in it, sufficient in quantity to cover the coils. The pan had not been opened in any way, and as it was not in use at the time, no one was near it. On the lower floor, say thirty feet below the top of the pan, stood the vacuum pump for said pan, and one of the workmen was engaged in examining the valves. Of course a light came into requisition, and a lighted candle was about to be introduced into the valve chamber when the gas, which had accumulated in sufficient quantity to fill the pan, gooseneck, saveall, and condenser, when the pipe that connects the condenser to the vacuum pump exploded with a report that was heard more than a mile away, and smashed the fine new pan and nearly all its belongings into fragments. Large pieces of iron were thrown with such force that the heavy timbers of the frame of the building were broken up in all directions, and some of the fragments were thrown through the walls of the house to a considerable distance. Fortunately no one was hurt except the man who was at the pump, who was badly scorched and scared. When asked if he had used used a candle in the pump, he said he had, but it was a very small one.

Great care should be taken to see that pans containing fermenting liquids are kept well ventilated during the time the liquid remains in them, and no one should enter such pans, either with or without a light, till the gas has been expelled. Cases have been mentioned to us of men entering pans containing gas that has been evolved from fermenting sugar and water, and dying there before anyone knew anything about it. Small matters sometimes cause great trouble, and had the Chinaman known that such a small candle could have caused such destruction and such harm to himself, he would not have been there with it. Few men, any more than the Chinaman, would have thought of exploding the pan through the pump, and the object of this article is to show the danger that, under certain circumstances, may arise from the accumulation, confinement, and ignition of such gases.—*Planters' Monthly.*

NOTICES OF BOOKS.

AGENDA ET CALENDRIER DE POCHE DU FABRICANT DE SUCRE, par le Docteur Ch. Stammer. Traduit de l'Allemand avec autorisation de l'auteur, et suivi d'un TRAITE D'ANALYSE CHIMIQUE, par H. Pellet et L. Biard, Chimistes. Paris, chez J. Fritsch, 67, rue de Richelieu.

This translation of the well known Kalender of Dr. Stammer would of itself be very welcome to those interested in the subject, who have not had time to acquaint themselves with the German language and may therefore be specially recommended on this account. To it, however, are added: 1. A synopsis of the French sugar legislative enactments, from 1880 to 1888 (the book appeared too early for the last enactment of August 5th, 1890, the operation of which the French fabricants may just possibly succeed in postponing): 2. Regulations in force respecting the sale and delivery of white and raw sugars, and the legal tares allowed by the customs authorities: 3. A tolerably exhaustive treatise on the various methods of analysis of raw material (beet), pulp, lime, fuel, juice and syrup, bone black, masse cuite, sugar, molasses, water, seeds, sugar-cane,—with a chapter on the detection of saccharine, followed by four chapters on distillery analysis—and, finally, a review of certain new inventions applicable to the sugar manufacture, with lists of the French sugar factories and sugar manufacturers.

The names of the authors are in themselves a guarantee of the value of such a handy little volume to scientific observers and skilled chemists, though we need hardly remind such of those as are at all *au courant* of facts, that the methods which have been so ably and persistently advocated by M. Pellet have not been accepted as completely satisfactory by all, especially by the German chemists. The question of the method of analysis to be adopted for raffinose is still a vexed one, and we can scarcely consider the Lindet method, even as improved by M. Pellett, as the one likely to be universally adopted, as it leaves much to be desired in the way of scientific accuracy. That portion of the book relating to analysis, comprising more than two thirds of the total number of pages, will be most acceptable to those who wish to become acquainted with the methods in use amongst French chemists, but we fear that many who may wish to consult it and whose time is precious, will deplore the want of an alphabetical index, the radical defect in so many invaluable works, which totally

prevents a rapid and effectual consultation of such books as the present. For our part, we heartily wish that a law were in existence, rendering obligatory the addition of such an index. Life is too short to spend much time in consulting tables of contents.

SUGAR ANALYSIS: for Refineries, Sugar-houses, Experimental Stations, &c., and as a Handbook of Instruction in Schools of Chemical Technology. By Ferdinand G. Wiechmann, Ph.D. New York: John Wiley and Sons, 1890. Sold by Kegan Paul, Trench, Trübner and Co., Limited.

The author has utilised his experience in the large sugar refinery of Messrs. Havemeyer and Elders, Brooklyn, in the production of a volume which cannot fail to be of immense use to the practical analyst. It has also the merit of great conciseness and avoidance of repetition, a quality of no small value in these over-busy days. The methods described are in many cases those which have appeared in the scientific and specialist journals of various countries, especially those of Austria, and are supplemented from the author's personal experience. To these are appended a series of nineteen tables, which are calculated to be of great service. There is one on English, German, and French synonymes, which is good as far as it goes, but is susceptible of further elaboration, and would then form a valuable aid to the student. The volume is handy, about 180 pages 8vo. well and clearly printed on good paper, and deserves to be recommended on all points, though perhaps the index might, with advantage, have been a little fuller.

THE SUGAR BEET INDUSTRY: Culture of the Sugar Beet and Manufacture of Beet Sugar, by H. W. Wiley, Chemist. Washington: Government Printing Office, 1890.

We have here another of those extremely interesting and carefully worked out elaborate reports which, from time to time, are issued by the United States Department of Agriculture. Professor Wiley's name is now well known as that of a thoroughly practical and conscientious scientific observer, whose knowledge is extensive and whose deductions are very valuable. The present work forms no exception to those hitherto issued, and coming at a conjuncture when the people of certain districts of the United States, favoured by the new tariff, are setting themselves heartily to work to see whether they cannot produce beet sugar as well as their European predecessors, it is doubly interesting. The historical part contains a succinct descrip-

tion of the rise and progress of the beet culture in Europe. There are numerous woodcuts and plates showing the best shapes of sugar-beets, the arrangements for preserving them in silos, &c., the machinery used in cultivation and harvesting, plans of sugar-houses in which the diffusion and other processes are carried on, and a map showing the belt of country in the States suitable for beet cultivation. These details of the illustrations will give an idea of the letterpress accompanying them, in which nothing of importance seems to have been omitted; and we may congratulate Professor Wiley on having rendered good service to the budding industry, similar to that which he has endeavoured to render to Sorghum growing. As regards the very large zone, 100 miles wide on each side of the mean isotherm of 70°F. for a period of 10 years (1879 to 1890), it seems to open up an indefinite future for beet growing and sugar producing, but we cannot overlook the fact the successful production of beet sugar depends much more on the co-operation of skilled field-labour and intelligent farming than on mere climatic conditions, and these desiderata are not obtained in a year nor in several years. On the whole, therefore, we may be permitted to doubt whether, in spite of the encouragement offered by the new tariff, any very immediate effect on the sugar production of the United States can be expected from beet culture. "The zone in question"—to quote from the *Sugar Beet*,—"pursues a serpentine course across the continent, and embraces the State of New York, part of Massachusetts and Vermont, the northern half of Pennsylvania, Ohio, Indiana, Illinois and Iowa, the southern portion of Michigan, Wisconsin, Minnesota and South Dakota; north and west Nebraska; northwest Kansas and east Colorado; all of New Mexico, Arizona, Utah, California, Idaho, and Washington."

ERRATUM.

Our attention has been called by the *Telegraphische Correspondenz* to an error in calculation in Table No. IV. on page 566 of our November issue, the cost of beets being put down at 413,720 instead of 513,720 marks, the result of which is that the ultimate cost per cent. of beets comes out at about 9s. 11d. instead of 8s. 7d. We much regret the oversight which led to the error being printed, as our only object is to arrive at truth, and the lower figure may already have produced a false impression. Some further criticisms of the *Telegraphische Correspondenz* will be replied to in our January issue.

Correspondence.

SEEDLING SUGAR CANES.

To the Editor of "The Sugar Cane."

Sir,—With regard to the much debated question of the priority of the discovery of the cane seed, I have taken the trouble to ask the former director of the "Samarang Experimental Station," Mr. H. Winter, to give his opinion on the point, which I consider to be of special value, he having been on the spot during most of the time when the experiments were being made by Dr. Soltwedel. As you have always adhered to the capital principle: *audiatur et altera pars*, may I ask you to be kind enough to give publicity to the information which Mr. Winter has very kindly forwarded me?

It is a great pity that the highly interesting scientific work of the Java Experimental Stations is not better known to those interested in the cane sugar industry in general; most of their publications about sugar matters—being only printed in Dutch—naturally have only a limited circulation. It would certainly be worth while to translate into English the numerous pamphlets and papers already published, and those who take an interest in careful scientific investigation into the peculiarities of the sugar cane cultivation and manufacture would, no doubt, be gratified if some eminent man, residing in Java, would collect the large quantity of published and unpublished information, much of which is comparatively unknown. Perhaps these remarks may have the effect of inducing some one to undertake the valuable, though laborious task of editing and translating such a work, as there is no doubt that the English language is the only one adapted for the purpose of general wide spread publicity.

I remain, Sir,

Yours, etc.,

Geo. Stade.

Berlin, Charlottenburg, 2,
10th November, 1890.

Geo. Stade, Esq., Berlin.

Dear Sir,—You have asked me, with reference to the statements in the *Sugar Cane* for September, respecting the priority of the discovery of seed from the sugar cane, to say a few words on the question. I am glad to respond to the request, as I was an eye witness during several years of the attempts which were made at the

Samarang Station in Java to grow canes from seed, and the first discoverer of the seed is now no longer able to speak for himself.*

Mr. Morris's supposition, that "the publication of the Java experiments will probably now claim precedence over all others with which we are at present acquainted," is quite correct. To the experimental station at Samarang belongs, not only the honour of having been the first to obtain seed from the cane and cane from seed, but also of having furnished the first detailed scientific description of the seed and the process of germination.

As regards the establishment of the first point, the fact does not appear to be as yet generally known that Dr. F. Soltwedel, at that time director of the experimental station in question, was already in possession of seed of the true sugar cane a year before Messrs. Harrison and Bovell. At any rate, Mr. G. Dureau, in an article "Les Graines de Canne à Sucre," (*Journal des Fabricants de Sucre*, for 16th April, 1890,) makes no mention of this, and the editor of the *Sugar Cane* (page 1, September, 1890,) expresses himself doubtfully on the point. The following are the words of Dr. Benecke in his treatise "Over suikerriet uit zaad," being a summary of Dr. Soltwedel's original communication:—

As early as the spring of 1885, Dr. Soltwedel had commenced, at the Bendokerep factory at Japara, his investigations with regard to the fructification, principally of *saccharum spontaneum*, L., (Glagah). He had observed that normal pollen grains were present in this species, which developed further on the pistil, and that fertilisation also took place resulting in the formation of actual seed. He had already succeeded, in 1885, in inducing these seeds † to germinate and obtained from them proper plants. In the same year Soltwedel was also engaged in studying the flowers of two varieties of *saccharum officinarum*, L., viz., Teboe Cheribon (Java), and Teboe Poetih (Beudokerep). In this case he also met with perfectly developed flowers, but observed neither germination of the pollen grains nor fructification. Although the reports of other investigators offered little encouragement to seek for seed from the first-named kind, yet Dr. Soltwedel was impelled to do so by seeing bees flying so often to the tassels of this cane. He assumed from this fact that the latter must contain something that enticed the bees, and further reasoned that the plants must be furnished with this means of attraction for

* Dr. Soltwedel died, December 17th, 1889, from syncope of the heart.

† Dr. B. uses, instead of seeds, the more accurate botanical form "fruits."

the benefit of their fructification. Hence he did not allow himself to be deterred by a series of unsuccessful experiments.

Dr. Soltwedel continued his observations in the experiment-field at Samarang, from April to July, 1886. In this year also he failed to find any seed formation in any variety of the true sugar cane, but in the case of *Saccharum Glonggong* (a kind of sugar cane growing wild in Java, in the same manner as Glagah, and also not cultivated), seeds of which he induced to germinate, he obtained individuals which were exactly similar to the mother plant.

In the year 1887, Soltwedel finally attained his object. As he formerly observed in the case of Loethers, a variety very rich in sugar, fertilisation without formation of seed, he first of all tried to obtain seed by crossing it with a wild kind which produced seed. Here we cannot refrain from reproducing the original report of Soltwedel, which appeared in the *Tijdschrift voor Land en Tuinbouw, etc.*, of the 1st July, 1887, in order to show how minutely he went into the question. He writes: "For the purpose of this experiment of cross-fertilisation we this year selected Glagah and Loethers; Glonggong was out of the question, because this kind of cane does not come into flower until Loethers has done flowering. But the endeavour to produce cross-fertilisation is accompanied, in the case of the sugar cane, with almost endless difficulties, because of the extreme minuteness of the flowers. By the aid of very small anatomical scissors we endeavoured to cut away the, as yet, unopened staminal buds from a number of flowers of Glagah and Loethers. After so doing we put into the thus partially sterilised flowers of Glagah, pollen dust of Loethers and *vice versa*."

As a matter of fact it was not possible to ascertain, later on, whether this cross-fertilisation had succeeded or not, however, almost at the same time, fertilisation was observed in the case of twenty varieties of the true cane other than the Loethers variety. Indeed in this year the formation of seed was also detected in nine different varieties. Soltwedel has given details of these in the following table:

VARIETIES OF SUGAR CANE PRODUCING SEED.

Name.	Whence obtained.	Percentage of flowers which formed seed.	Weight of a seed grain in milligrams.	Percentage of germinating seeds
Yellow Cane........	Hawaii	.. 3·0	.. 0·20	.. 16
Teboe batoeng	Borneo	.. 6·0	.. 0·16	.. 15
,, koening	,,	.. 4·5	. 0·10	.. 6
Branche blanche	Mauritius	.. 31·0	.. 0·15	.. 35

VARIETIES OF SUGAR CANE PRODUCING SEED.—*Continued.*

Name.	Whence obtained.	Percentage of flowers which formed seed.	Weight of a seed grain in milligrams.	Percentage of germinating seeds
Loethers	Mauritius	0·37	0·20	—
Teboe rapooh	Java	0·23	0·22	—
Teboe soerat balie ..	,,	0·36	0·20	—
,, ,, redjoe..	,,	13·7	0·11	3
,, idjoe	,,	0·8	0·20	20
Glonggong	,, (wild)	8·5	0·16	—
Glagah	,, (wild)	24·0	0·34	—

"Thus, in a spikelet of Branche blanche we found the greatest number of seeds, out of 100 flowers there were 31 on the average which had formed one seed each. In the case of Teboe rapooh we found the fewest seeds, as there was only one seed to 435 flowers. The seeds are exceedingly small, those of Glagah being the largest, and those of Teboe koening and Teboe soerat redjoe the smallest."

A very large number of the seedlings perished; only from the yellow Hawaii cane did Soltwedel (in 1887) obtain *strong plants which grew to* $2\frac{1}{2}$ *metres*. In the year 1888 he divided these into cuttings, and obtained from them in the following year plants of $3\frac{1}{2}$ metres high.

From what has been stated, there can be no doubt as to the man to whom belongs the honour of the discovery of the sugar-cane seed. Without wishing to hurt the feelings of the West Indian investigators or to diminish their universally acknowledged merits, we cannot help pointing out the difference between Soltwedel's successful striving for an object as to which he was certain, and (if we are to judge by the published reports) the more accidental discovery of Harrison and Bovell, and declaring that at least equal acknowledgement with that which they receive is due to the German investigator. As far back as 1887, Soltwedel was actually in possession of the seeds, whilst the Barbados investigators, as Morris correctly points out (page 488), had, in 1888, only arrived at a conclusion (which was still open to dispute) as to the existence of seeds from germinating cane plants, and indeed, as the same writer indicates on page 491, had probably only examined the pistil in the cane flower for seed, without being acquainted with the seed itself.

Further, besides Soltwedel, another planter in Java, Dr. L. Ostermann, had in June, 1887, obtained seedling plants by sowing whole tassels in moist soil (Benecke, page 51). Afterwards, a chemist named Schmitz, Dr. Ostermann, and more especially Dr. F. Benecke,

obtained numerous plants by sowing isolated seed grains, the whole of which the writer had the opportunity of seeing.

I have already mentioned at the outset that the first scientific description of the sugar cane seed had issued from the Samarang Station, in the shape of the pamphlet of Dr. F. Benecke, who was labouring there along with Soltwedel as botanist. This work, which Morris characterises as "a very clear and exhaustive account of the whole matter, illustrated by excellent drawings and dissections," was begun in May, 1889, and finished somewhere about September of the same year. The translation, (the MS. was written in German), execution of the drawings, and printing were surrounded with very special difficulties, so that the latter was not completed until January, 1890. The description, which Mr. Morris read on the 10th March, 1890 (*Sugar Cane*, September, page 488), before he received the pamphlet of Dr. Benecke, and which had occupied him "several weeks," is undoubtedly of later origin.

So much towards clearing up the question as to priority of discovery. I may add, in conclusion, that in Java itself people do not attribute to the discovery of the seed that importance for the practical culture of the cane which they appear to do in the West Indies and other countries.

I hope I have met your wishes in this matter, and remain

Yours fraternally,

H. WINTER.

DIFFUSION *v.* CRUSHING.

TO THE EDITOR OF "THE SUGAR CANE," Manchester, England.

Sir,—There appears in the issue of "Sugar Cane" for September 1st, 1890, a reprint of an article by Mr. Nevile Lubbock communicated to "Timehri," entitled "Diffusion of sugar cane compared with double crushing in mills," in which the author proceeds to show that according to the published statements of diffusion work in the United States there would be a loss in using the "diffusion process" in working up sugar cane in Demerara. Mr. Lubbock's paper is an exceedingly able one, no doubt his points are well taken from the information available to him.

Having had some experience in this country with diffusion work extending over the past three years, it may be interesting for you to know how the apparatus and process works with us; and as comparison between the estimates of Mr. Lubbock and the statements herein

made will certainly be instituted, it will be as well to use Mr. Lubbock's method of striking a balance. In this country single crushing never gives more than 64% in juice on the weight of cane, and dry double crushing may be put at 72% as a maximum; where maceration, or hot water applied to the megass between the mills, is used, the extraction will vary, and it is not easy to arrive at correct results by weighing juice and cane; by analysis of cane and megass it has been determined that where water of maceration to the extent of say 10lbs. per 100 of normal juice has been applied, the extraction is equivalent to about 75% of juice on the weight of the cane; the application of this water is, however, known to lower the purity of the juice to quite an extent, and whether this has any effect upon the returns of commercial sugar, has not, up to the present time, been ascertained as far as we know.

Mr. Lubbock's estimate of 72% as the results of *dry* double crushing may be accepted as about correct as far as we are concerned; but the cane in this country rarely contains on the average more than 11% of woody fibre, which materially alters the returns as shown by balance.

Every diffusion house with us can obtain an average extraction of 96% of sucrose contained in the cane with a dilution of 25lbs. water added per 100 of normal juice, and it may be said that most of them get this; this is equivalent to an extraction of juice on the weight of the cane of 96-100ths of 89% equal to 85·44%, say in round numbers 85·5%.

The difference then between 72% and 85·5% is 13·5, and 13·5 parts on 72 parts equals 18·7%, a very material gain.

Following Mr. Lubbock's lead, we will suppose a double crushing plant capable of taking off say 20 tons of commercial sugar per diem, which has been modified and added to in order to convert it into a diffusion plant of equal capacity as regards tonnage of cane worked up; 20 tons of commercial sugar per day will work off a crop of 2,000 tons in, say four months, about the most favourable condition for a sugar mill to be in, to leave the manager free to get in his plant, and to work his ratoons to the best advantage.

To make 20 tons of sugar per day will require 170 tons of cane with dry double crushing at 8½ tons cane per ton sugar; we will suppose the double crushing plant to be fitted up with triple effect and vacuum pans, centrifugals, &c., sufficient to work up the juice delivered in 12 hours, which is the average day's work in our mills; then the labour account for a mill of this size will be as follows:—

Men at cane carrier at 12 tons cane per man per day	14 at $0·80	..	$11·20
Men feeding the mill, and overseer	3 at $1·00	..	$3·00
Man cleaning up between the two mills and throwing back	1 at $0·80	..	$0·80
Man at juice screens	1 at $0·80	..	$0·80
Man at mill engines	1 at $1·00	..	$1·00
Men at clarifiers	3 at $1·00	..	$3·00
Men at sweeping pans	2 at $1·00	..	$2·00
Men at filter presses	2 at $1·00	..	$2·00
Man at triple effect	1 at $1·00	..	$1·00
Men at vacuum pan, sugar boiler, at $125·00 per month; 1 assistant at $1·00 per day......		..	$6·00
Men at centrifugals, 1 overseer and 4 men	at $1·10	..	$5·50
Men in packing room	3 at $1·00	..	$3·00
Women sewing bags	3 at $0·30	..	$0·90
Men at coolers attending to low goods	4 at $0·80	..	$3·20
Engineer in charge of machinery, at $125·00 per month			$5·00
Firemen at boilers including water tenders.....................	3 at $1·00	..	$3·00
Engineer's assistant, oiling and looking after pumps..........	1 at $1·25	..	$1·25
			$52·65

Which, divided by output is equivalent to $2·63 per ton sugar. Sugar bags, holding 130lbs. each, cost $0·09, including twine for sewing $1·39 per ton sugar. Total cost of sugar, manufactured and bagged, say $4·00 per ton.

It will be noted that no item for coal is inserted; we do not use coal where dry double crushing is in vogue, notwithstanding the fact that our canes contain only 11% fibre against 13% in Demerara; excepting in rare cases there is usually enough megass left at the end of grinding season to start the boilers at the beginning of next.

The cost for a double crushing plant for 20 tons per day in this country put up in working order is about $125,000·00.

Then the sugar house is debtor to

Wear and tear and interest at 10% on $125,000·00	$12,500·00
Cost of manufacturing 2,000 tons sugar and bagging the same ready for delivery at $4·00	$8,000·00
	$20,500·00
And 17,000 short tons of cane at say $5·00 ..	$85,000·00
	$105,500·00
It is creditor by	
5,000 tons of sugar at say $80·00 per ton nett to the mill	$160,000·00

The by products in this country are of no value, and are usually run into the sea.

To convert this crushing plant into a diffusion plant will require the expenditure of about $50,000·00; Mr. Lubbock's estimate of £16,000 being greater than the amount required to convert a 40 ton crushing plant into a diffusion plant of equal capacity, which was done here some two years ago. To run diffusion works successfully, day and night work is required, but not in the field, as the battery can be designed to work up, as in this instance, 170 tons of cane per 24 hours, while the force required to bring this to the mill remains as before.

Then, carrying out the labour required as above, and bearing in mind that the day will be divided into two watches of 12 hours each,

Men to feed carrier to slicing machine, at 12 tons per hour, day watch	7 at $0·80	..	$5·60
Ditto night watch..............	7 at $0·90	..	$6·30
Men feeding the slicing machine, day watch	2 at $1·00	..	$2·00
Ditto night watch..............	2 at $1·10	..	$2·20
Overseer, day, at $1·00; overseer, night, at $1·10 ..			$2·10
Men on upper floor of battery, day watch	3 at $1·00	..	$3·00
Ditto night watch..............	3 at $1·10	..	$3·30
Man below, day watch...........	1 at $0·80	..	$0·80
Ditto night watch..............	1 at $0·90	..	$0·90
Man attending to mills squeezing exhausted chips, day	1 at $0·80	..	$0·80
Ditto night watch..............	1 at $0·90	..	$0·90
Man at triple effect, day watch..	1 at $1·00	..	$1·00
Ditto night watch	1 at $1·10	..	$1·10

Men at vacuum pan, sugar boilers, 1 day, 1 night, at $125·00 per month	2 at $5·00	..	$10·00
Men at centrifugals (drying done in day time)	5 at $1·10	..	$5·50
Men in packing room	4 at $1·00	..	$4·00
Women sewing bags	4 at $0·30	..	$1·20
Men at coolers attending to low goods	4 at $0·80	..	$3·20
Engineer in charge of machinery at $125·00 per month			$5·00
Firemen at boilers including water tender, day	3 at $1·00	..	$3·00
Ditto night	3 at $1·10	..	$3·30
Engineer's assistant, oiling and looking after pumps, day			$1·25
Ditto night			$1·50
			$67·95

Estimated gain by diffusion 18·7% equals 3·74 tons. Total output per diem of 24 hours equals 23·74 tons.

Sugar bags, holding 130lbs. each, including twine, per ton	$1·39
Cost for manufacture per ton say	$2·86
Coal per ton of commercial sugar from actual record	$3·57
Total cost of sugar, manufactured and bagged	$7·82

This estimate of cost of coal is based on what it actually cost a sugar house which turned out 6,800 tons of commercial sugar this past season in this country, coal costing at furnace mouth $10.50 per long ton.

Now on this estimate the sugar house is debtor to

Wear and tear and interest at 10% on original investment	$12,500·00
Wear and tear and interest on improvements at 10%	$5,000·00
Cost of manufacturing and bagging 2,374 tons sugar at $7·82	$18,564·68
	$36,064·68
And 17,000 short tons of cane at say $5·00 per ton	$85,000·00
	$121,064·68

It is credited by

2,374 tons sugar at $80·00 per ton nett	$189,920·00
Balance of profit shown for the crushing plant	$54,500·00
Balance of profit shown for the diffusion process	$68,855·32
Balance of profit in favour of diffusion process	$14,355·32

or nett profit per ton sugar made of say $6·00, which corresponds very closely to the nett gain in this country. It is right to add in this connection that diffusion sugars in this country have realised a higher price than ordinary, owing to the enhanced polarization, in one instance this amounted to ⅛ cent per lb. sugar or $2·50 per ton, which is an additional credit to be added to the above; this is owing to sugars being sold here on the basis of 96% polarization and every degree above netting ⅛ cent. per lb. more, every degree below ⅛ cent. off.

This, however, not obtaining in other countries it does not appear in balance.

It will be noted that this is gain obtained on a remodelled plant, where opportunity serves to design a diffusion plant complete, great reduction in cost can be made.

To refer to Mr. Lubbock's article again, he assumes that it costs as much to crush chips as cane, the fact is that less than half the power is required to reduce chips to fuel containing 50% moisture, than is required to crush cane to a 72% extraction, this has been abundantly proved here by fairly accurate observations with the indicator; the 40 ton diffusion plant already referred to requires only 118 horse power when all the machinery, including 12 centrifugals, is running. This was deduced from a series of indicator diagrams taken from every prime mover in the mill, to determine the weight of high-pressure steam required to do the work.

This will be noted as a large reduction in power required for a sugar house; other economies can be practised, and in fine a diffusion plant should cost very little, if any more than a double crushing plant of equal capacity.

The diffusion process, as applied to sugar cane, is in its infancy as yet; great improvements will be made in the future; but it is certain that the cane sugar producer, to hope to compete on even terms with his rival of the beet, must be equipped with the same tools and methods of using them, he must apply the same care and study to prevent losses and to improve upon good work; the more that go in for this, the coming process, the sooner will design and manipulation be perfected; and if the statements made in this letter add anything to the stock of knowledge on this subject, its object is attained.

Very truly yours,

Union Iron Works Co., J. N. S. WILLIAMS.

Honolulu, H. J., October 17th, 1890.

IMPORTS AND EXPORTS (UNITED KINGDOM) OF RAW AND REFINED SUGARS.

JANUARY 1ST TO OCTOBER 31ST.

Board of Trade Returns.

IMPORTS.

Raw Sugars.	Quantities.		Value.	
	1889.	1890.	1889.	1890.
	Cwts.	Cwts.	£	£
Germany	4,660,563	5,388,948	3,782,713	3,266,037
Holland	384,337	366,986	320,427	212,725
Belgium	786,566	883,866	542,150	517,312
France	169,018	1,026,160	140,961	643,558
British West Indies & Guiana	1,537,648	1,141,318	1,467,502	857,836
British East Indies	1,684,326	626,684	1,145,992	323,126
China and Hong Kong	40,774	....	31,716	....
Mauritius	291,050	214,803	285,079	135,273
Spanish West India Islands	49,535	42,130	44,230	31,597
Brazil	702,058	333,849	502,381	202,453
Java	1,788,072	1,023,318	1,612,262	727,686
Philippine Islands	928,709	242,433	565,056	128,335
Peru	579,937	544,922	479,338	369,726
Other Countries	630,191	333,232	555,899	236,116
Total of Raw Sugars	14,232,784	12,168,649	11,475,706	7,651,780
Molasses	361,777	538,093	134,831	174,435
Total Sugar and Molasses	....	....	18,625,913	14,308,251
Refined Sugars.				
Germany	3,253,137	3,851,834	3,367,371	3,116,115
Holland	1,073,133	1,519,018	1,111,314	1,263,845
Belgium	194,163	132,547	206,980	118,387
France	1,621,020	2,168,186	1,687,883	1,762,938
United States	10,018	259,656	9,713	217,088
Other Countries	630,565	4,309	632,115	3,663
Total of Refined	6,782,036	7,935,550	7,015,376	6,482,036

EXPORTS.—Refined Sugars.

	Cwts.	Cwts.	£	£
Sweden and Norway	60,920	55,141	55,469	41,009
Denmark	105,974	111,504	84,187	68,722
Holland	76,001	75,662	63,739	53,766
Belgium	23,609	24,597	17,864	17,108
France	5,813	4,772	4,599	3,114
Portugal, Azores, & Madeira	68,640	67,900	56,264	45,621
Italy	82,582	65,615	71,637	44,699
Other Countries	126,678	185,082	114,114	142,012
Total of Exports	550,217	590,273	467,873	416,051

IMPORTS OF FOREIGN REFINED SUGAR.

The British Sugar Refiners' Committee furnish us with the following figures, giving the imports of foreign refined sugar for the month of October, 1890, compared with the corresponding month of the two preceding years, and the average monthly imports for the year compared with those of 1887, 1888, and 1889, distinguishing the quantities of "Lumps and Loaves" from "other sorts," and giving the separate imports from each country:—

Countries from which Sugar has been imported.	"Lumps and Loaves."							"Other Sorts." Including Crushed Loaf, Granulated, Crystallized, &c.							Total.						
	Monthly Average.				Oct.	Oct.	Oct.	Monthly Average.				Oct.	Oct.	Oct.	Monthly Average.				Oct.	Oct.	Oct.
	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890	1887	1888	1889	1890	1888	1889	1890
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France	1363	1686	2373	2883	1416	3027	1354	5099	4855	8596	7956	10037	16752	12174	6462	6541	10969	10839	11453	19779	13528
Holland	3780	3267	2294	2972	3001	2527	2315	2483	2675	3354	4622	3609	4935	5011	6263	5942	5648	7594	6610	7462	7326
Germany & Austria	1347	1510	2573	2449	446	2348	948	10463	11729	13844	16810	5940	11066	10759	11810	13239	16417	19259	6386	13414	11707
Belgium	592	622	827	371	444	716	444	308	227	225	291	211	223	767	900	849	1052	662	655	939	1211
United States	454	8	..	113	..	..	..	2804	157	42	1185	10	6	717	3258	165	42	1298	10	6	717
Russia	3	..	23	..	..	..	..	452	1959	2015	..	87	50	..	455	1959	2038	..	87	50	..
Other Countries	..	1	239	..	..	..	..	15	2	355	21	..	110	4	15	3	594	21	..	110	4
Total	7539	7094	8329	8788	5307	8618	5061	21624	21604	28431	30885	19894	33142	29432	29163	28698	36760	39673	25201	41760	34493

SUGAR STATISTICS—GREAT BRITAIN.

FOR THE FOUR PRINCIPAL PORTS.

To November 15th, 1890 and 1889. In Thousands of Tons, to the nearest Thousand.

	Stocks. 1890.	Stocks. 1889.	Deliveries. 1890.	Deliveries. 1889.	Imports. 1890.	Imports. 1889.
London	21	50	242	278	216	300
Liverpool ..	45	79	240	268	203	266
Clyde......	17	23½	183	207	180	217
Bristol	0½	1½	55	45	55	43
Total ..	83½	154	720	798	654	826

The above figures do not represent accurately, or to the full extent, the position and movements of sugar in the United Kingdom, as Hull, Leith, &c., are not included, there being no published returns for these ports.

SUGAR STATISTICS—UNITED STATES.

(From Willett & Gray's Report.)

For the four principal Ports. In Thousands of Tons, to the nearest Thousand. For October, 1890 and 1889.

	Stocks. November 1st. 1890.	Stocks. November 1st. 1889.	Deliveries. In Oct. 1890.	Deliveries. In Oct. 1889.	Imports. In Oct. 1890.	Imports. In Oct. 1889.
New York	13	28	42	45	36	41
Boston	½	1½	7	2½	5	2
Philadelphia....	..	..	20	18½	20	18
Baltimore	..	..	..	..	..	..
Total......	13½	29½	69	66	61	61
Total for the year..........			1038	901	1040	899

NEW YORK PRICES FOR SUGAR.

From Willett & Gray's Report, November 13th, 1890.

Fair Refining.	96o/o Centfs.	Granulated.	Stand. A.	Stock in Four Ports.
Nov. 13, 1890.—4⅞c.	5⅛c.	6⅛c.	5⅞c.	Jan. 1, 1890— 11,169 tons.
Nov. 14, 1889.—4¼c.	5⅝c.	6⅞-15-16c.	6⅝c.	Jan. 1, 1889— 32,254 tons.
Nov. 15, 1888.—5 1-16c.	6¼c.	7¼c.	6⅞c.	Jan. 1, 1888— 47,798 tons.
Nov. 17, 1887.—5 3-16c.	6c.	6⅝-11-16c.	6 5-16c.	Jan. 1, 1887—102,279 tons.
Nov. 18, 1886.—4⅜c.	5⅜c.	5 11-16c.	5¼c.	Jan. 1, 1886— 57,328 tons.
Nov. 19, 1885.—5⅜c.	6c.	6⅛c.	6 3-16c.	Jan. 1, 1885— 89,186 tons.
Nov. 13, 1884.—5c.	5⅜c.	6⅜c.	5 13-16c.	Jan. 1, 1884— 60,900 tons.
Nov. 15, 1883.—6⅜c.	7 9-16c.	8⅛c.	7½c.	Jan. 1, 1883— 50,297 tons.
Nov. 16, 1882.—7⅜c.	8c.	8⅞c.	8⅛c.	Jan. 1, 1882— 43,927 tons.
Nov. 17, 1881.—8⅛c.	8 13-16c.	9 11-16-¾c	9¼c.	Jan. 1, 1881— 66,999 tons.

STOCKS OF SUGAR IN THE CHIEF MARKETS OF EUROPE ON THE 31ST OCTOBER, FOR THREE YEARS, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal *entrepôts.*	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
85	160	86	104	7	15	457	599	429

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST OCTOBER, IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany	France.	Austria.	Holland.	Remaining four principal *entrepôts.*	TOTAL 1890.	TOTAL 1889.	TOTAL 1888.
1336	496	521	310	50	380	3093	2789	2729

ESTIMATED CROP OF BEET ROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE PRESENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1890-91. Tons.	1889-90. Tons.	1888-89. Tons.	1887-88. Tons.
German Empire ..	1,250,000 ..	1,264,607 ..	990,604 ..	959,166
France..........	770,000 ..	753,078 ..	466,767 ..	392,824
Austria-Hungary..	760,000 ..	787,989 ..	523,242 ..	428,616
Russia..........	530,000 ..	465,000 ..	526,387 ..	441,342
Belgium	200,000 ..	221,480 ..	145,804 ..	140,742
Holland	50,000 ..	55,813 ..	46,040 ..	39,280
Other Countries..	75,000 ..	80,000 ..	87,000 ..	79,980
Total....	3,635,000	3,627,967	2,785,844	2,481,950

It will be observed that Mr. Licht reduces his estimate of last month by 50,000 tons, the reductions being in France and Austria. The complaints of the French manufacturers meet with little credence outside of France itself, as the general feeling is that they were much exaggerated in order to bring pressure to bear on the Government.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The market for cane sugar during the past month has again been quiet; the small quantities offering have met with fair sale. The cautious policy lately adopted by buyers, most fully warranted by the state of the market, has been accentuated by the unsatisfactory state of the money market. Several lots of the finer kinds of Demerara which are now freely offering went off at tolerably good prices, but a general further decline of 3d. to 6d. has been established on all kinds of raw sugar.

Beet sugar fell slowly but steadily during the month, but under the influence of the gradual recovery of the money market, and a reduction in the estimates by Mr. Licht of the coming crop, recovered somewhat, and closes about 6d. under last month. The evidence at present available points to a production on the Continent about equal to that of last year; the French manufacturers and agriculturists do not appear to have established their case, and on the whole we do not see anything that should bring about an advance in beet sugar prices for the present. Refined sugars remain without any great alteration.

The attitude of the trade all round may be described as a waiting one.

The relative position of stocks, deliveries and imports as compared with those of last year, continue much the same as last month. The consumption in Europe is beginning to show a decline, thus further indicating that much of the apparent increase was due to the replenishing of the previously exhausted invisible stocks.

Present quotations for the standard qualities, as under, are :—

Floating.			Last Month.
Porto Rico, fair to good Refining	12/9 to 14/–	against	13/6 to 14/9.
Cuba Centrifugals, 97°/$_o$ polarization	14/6	,,	15/– to 15/6.
Cuba, fair to good Refining	13/– to 13/6	,,	13/3 to 13/9.
Java, No. 14 to 15 D.S...	14/9 to 15/–	,,	15/6.
British West India, fair brown..	12/3	,,	12/6
Bahia, low to middling brown	11/3 to 11/9	,,	11/6 to 12/–.
,, Nos. 8 to 9	12/– to 12/3	,,	12/3 to 13/8.
Pernams, regular to superior Americanos.	11/6 to 12/9	,,	11/9 to 13/9.

Landed.			Last Month.
Madras Cane Jaggery..	10/3	against	10/9
Manila Cebu and Ilo Ilo	10/–	,,	10/6

Paris Loaves, f.o.b...	16/9	against	16/9
Russian Crystals, No. 3, c.i.f.	None offering.		
Titlers	17/9	,,	18/–
Tate's Cubes..	19/–	,,	19/–
Beet, German and Austrian, 88%, f.o.b. ..	12/3	,,	12/9